

CSIR NEWS

CBRI designs Earthen Embankment for Hindalco's Ash Pond

THE Central Building Research Institute (CBRI), Roorkee, was entrusted by M/s Hindalco Industries Limited, Renukoot (U.P.), the 'Design of Earthen Embankment for Ash Pond' at Hindalco. The ash pond is about 8-10 years old and used for storing the boiler ash coming out from the plant. It is about 21m in height from the ground level. CBRI modified the layout plan of the ash pond to increase its capacity and worked out the design of a safe and economical earthen embankment for the pond, based on geotechnical investigations.

Soil samples (13), ash samples (2) and filter materials (4) were collected from different locations and analyzed in laboratory to determine the physical properties: grain size distribution, Atterberg's limits, compaction characteristics of soils, flyash and soil-flyash mixtures, shear strength parameters using small and large size direct shear box apparatus and permeability coefficient of soil by consolidation test, etc.

The soil and flyash samples revealed wide variability in gravel (3-95%), sand (5-60%), silt and clay contents (0-52%). Flyash contained 50-60% sand and 40-41% silt and clay contents. Twelve samples were found to be of non-plastic nature and three samples revealed $W_L = 30-33\%$ and $W_p = 6\%$. However, these were found suitable for the construction of embankment.

The compaction characteristics of soil samples revealed the maximum dry density ranging from 16.0 KN/m^3 to 19.1 KN/m^3 and OMC ranging from 11.0% to 25.3%. The maximum dry density and OMC of flyash samples were found in order of $11.3-12.7 \text{ KN/m}^3$ and 35.8-29.2% respectively. The soil-flyash mixtures having flyash 20-40% by weight were found to possess maximum dry density ranging from $18.1-15.1 \text{ KN/m}^3$ and OMC 13.3-28.6%. The compaction characteristics of soil flyash mixture, carried out by layering in the ratio of 2 soil : 1 flyash by volume revealed maximum dry density (16.2 KN/m^3 and OMC equal to 15.6%) showing re-

duction in density and increase in OMC. This study was carried out with a view to utilizing flyash for the construction of embankment. Flyash, a waste product, was posing serious environmental and disposal problems.

The optimum values of shear parameters, namely cohesion and angle of internal friction, determined on the basis of total stress approach, were found to be 16-33 K and $12.4-28^\circ$ respectively, to undertake slope stability analysis of earthen embankment. The coefficient of permeability of embankment material was worked out to be $K = 3.80 \times 10^{-3} \text{ cm/s}$.

The layout plan of ash pond was modified to increase the capacity of the pond, and a safe and economical earthen embankment was designed. Efficient downstream drainage filters and toe drains were provided in embankment to control the percolating water at the exit and allow its safe discharge without inducing piping. The design criterion suggested by Terzaghi was further modified by USBR & BIS and using

the locally available filter materials. The design of decantation well, settling tank and a *pucca* drain were also worked out for improving the functioning of the embankment. The stability analysis of 21m high embankment was carried out following Swedish Circle method. The slope stability analysis covered three conditions, viz. stability of d/s

slope under steady seepage, stability of u/s slope under sudden draw-down and stability of both d/s and u/s slopes immediately after construction. On the basis of shear parameter inputs ascertained, the factor of safety was worked out to be between 1.8 & 2.0 in case of total stress consideration. □

Studies on Wind Climate for Building Designs

KNOWLEDGE of wind climate is of paramount importance from environmental and structural point of view in the design of buildings. By making use of various statistical methods, several investigators have generated information on parameters like mean wind speeds, most probable wind speeds, standard deviations, coefficients of variation, wind power densities, etc. Information on seasonal, inter-seasonal and inter-annual variability of wind data is also quite useful for identification and regionalization of homogeneous wind climatic zones for building designs. With a view to generating this information, extensive investigations on wind climate in India for building design purpose have been undertaken by Central Building Research Institute (CBRI), Roorkee.

Data on mean monthly wind speed for the period 1931-1990 for 120 stations spread all over the country were procured from India Meteorological Department and subsequently analyzed to determine the values of the Annual Average Wind Speed, Standard Deviation, Skewness and Kurtosis for each of the afore-said stations. Further, to study the variability of wind speed in space and time, the data were also subjected to rigorous analysis using various multivariate statistical methods. Principal Component

Analysis Method, a well-known multivariate statistical technique, which produces a decomposition of data field into spatial Eigen Vectors and Temporal Time Series, was used to work out Eigen Values and Principal Components.

To determine the number of Principal Components, which are significant and need to be used for studying spatial and temporal variations of wind speed and also for identification of homogeneous regions, Eigen Values were normalized and compared with the simulated significance bands. It was observed that first four Principal Components together explain 65-70% of total variance. Hence, correlations were derived among the station data and the first four Principal Components only. Finally, stations which were significantly and maximally correlated with respect to the same Principal Components were grouped together and zones of wind homogeneity were identified. All stations within a zone correlated positively pairwise.

Variability of the first and second Principal Components (PC1 & PC2) of average wind data for 70 years' period (1921-1990) for 57 stations was also studied. A plot of PC1 v/s PC2 provided comprehensive information about the periods

for which wind speeds had been excessive, normal or low as compared to the average wind speeds. The ideal normal year, i.e. when each station received exactly its own average wind speed, has all Principal Components as zero. Such a year coincides with the origin in the plot. Closeness of two or more years on this plot indicated occurrence of identical wind conditions for these years.

The autocorrelation functions (ACF) of time series of 57 stations were also computed in terms of their eight lagged values. It was found that the value of ACF decreases as the lag increases and the ACF values are highly significant at all the eight lags. Thus, the autocorrelation function of the wind time series showed the series to exhibit a definite trend and good correlation. Time series of the first four Principal Components were prepared using the seasonal and annual wind speed data. The plot of these series clearly shows the occurrence of about 60 years' wind cycle in India. Power Spectral Density (PSD) function of each Principal Component series was also worked out to find out whether the data are purely random or white noise. Significant PSD peaks were observed around the frequency of 0.016 cycles/year, which corresponds to a period of about 60 years. This corroborates the findings of occurrence of about 60 years' wind cycle in India. □

SST and All India Summer Monsoon Rainfall

A strong association between the October Sea Surface Temperature (SST) of the previous year in the eastern equatorial

Indian Ocean (0-5°N, 80-85°E) and all India monsoon rainfall in the following year, had been reported earlier by the National Institute of Oceanography (NIO), Goa, by using a small sample of 20 years' data set. The relationship has now been veri-

fied by using a large sample of 50 years' (1941-90) data on SST and trend in Southern Oscillation Index (SOI) during January-April. The computation of correlation between the difference in rainfall, SST and SOI [year (-1) - year (0)] has been

found to be 0.69 (significant at 95% level), the correlation between SST and rainfall is 0.49 while the correlation between SOI and rainfall is 0.56 (both significant at 95% level). □

CENTRAL FUEL RESEARCH INSTITUTE, DHANBAD

R&D Highlights: 1996-97

THE major areas of research at the Central Fuel Research Institute (CFRI), Dhanbad, relate to: Coal Resource Quality Assessment and Preparation/Beneficiation, Efficient Energy Systems and Waste Utilization, Heavy Residue Processing and Process Engineering, Catalysts, Carbon Products and Environmental Impact Studies.

During 1996-97, more than 50 projects were investigated on behalf of nearly 30 clients in the organized sector, and nine projects were concluded. Thirty-eight research papers were published, four patents filed and 24 technical reports prepared. Scientists of the institute participated in 27 national and two international seminars. Four monographs in the areas of the institute's expertise were brought out marking the Golden Jubilee of the institute.

The institute witnessed 30% increase in total outlay over the previous year, with a corresponding increase of 13% in the availability of extra budgetary support from CSIR. The earnings made during the year formed 20% of the support from CSIR.

Highlights of major activities during 1996-97:

Utilization of Botswana coals: The institute won an international contract in open competition to pro-

vide consultancy to Botswana Technology Centre, Republic of Botswana, for the utilization of the coals found there. The objective of the consultancy was to establish techno-economics of coal utilization in Botswana as a domestic and industrial fuel to save forests and also to find an alternative to coal being imported from South Africa.

The assignment has been completed on schedule and techno-economic assessment made to establish a 1.2 million tonne Coal Processing Complex, involving beneficiation, briquetting and soft coke manufacture. An estimated investment of US \$25 million is expected to provide 13.6% return on investment.

Madhya Pradesh coal for power generation: CFRI is providing technical assistance to M/s Burns & Roe, USA, under contract with the US Department of Energy, for improving the quality of coal found in Madhya Pradesh, for power generation.

Coal resource quality assessment: Borehole core of 22,881 m was processed and 41,048 samples were studied in support of the explorations carried out by the Geological Survey of India (GSI), Central Mine Planning and Design Institute (CMPDI), Ranchi, and others in 26 coal and lignite fields. In addition, 16,804 samples were analyzed for

the Coal Controller (CC), Government of India, and other customers.

Standardization and coal quality monitoring of washery despatches: The institute has undertaken studies to improve the quality of coal produced from the washeries of Bharat Coking Coal Ltd (BCCL), on behalf of Coal India (CIL) and Steel Authority of India Ltd (SAIL). These studies have resulted in stabilization/improvement in the quality of washed coal, and also in the improvement in the infrastructure at all the seven washeries. As a consequence of these studies, SAIL is likely to reduce the import of coal by 5% and the services of CFRI are expected to be availed by the washeries of Central Coalfields Ltd (CCL), Ranchi, also.

Characterization of coal and lignite ashes: On behalf of Standing Scientific Research Committee (SSRC), Ministry of Coal, Government of India, investigations have been made to estimate the α -quartz, total silica, and major and trace element content of ash in coals from Durgapur OCP; Chandrapur, WCL, Nagpur; Northern Coalfield (Bina Project, Purewa Seam); and Central Coalfield (Pipawar OCP). The studies made so far show that the α -quartz and total ash are directly related to each other and the relationship can be used to predict the

α -quartz content from ash values with 97% certainty.

More than 520 coal samples were studied through Gieseler and Sapozhnikov Plastometric tests, Low Temperature Gray King Assay (LTGK), High Temperature Gray King Assay (HTGK), Swelling Index (SI), Roga Index (RI), proximate analysis and about 130 coke samples for reactivity towards CO₂, CRI and CSR, true and apparent density, size analysis, Micum and Shatter tests, etc. A large number of samples of coal ash, mine gas constituents and coal tar fractions were analyzed. Analyses included determination of ash fusion range, free silica and α -quartz besides trace and heavy metals.

Studies on the environmental pollution caused by coal based industries in the vicinity of Dhanbad, due to suspected particulate matter (SPM), oxides of nitrogen (NO_x) and sulphur (SO_x), were conducted by sampling and analysis of ambient air monitoring of stack emissions. Investigations to assess the quality of water were also undertaken.

Sampling and analysis of α -quartz in respirable air-borne dust particles collected from mines of Manganese Ore India Ltd (MOIL), situated in M.P. and Maharashtra, were accomplished.

About 50 samples collected from different locations of Jharia coalfield area were studied for quantification of arsenic, mercury and selenium content.

Bulk washing of coals from Amla and Dhori East: Work on the beneficiation of coals from Dhori Mines, belonging to Karo VI/VII/VIII seams, has been completed for CCL. These investigations reveal that coals from these sources, not presently booked to washeries, are high ranking with mean reflectance of

1.32, and cleaning possibilities exist to fully utilize the resource through a multi-product washery.

Beneficiation of lower seam coals of Jharia: These investigations have been undertaken at the instance of Coal Conservation and Development Advisory Council (CCDA), Ministry of Coal, Government of India, New Delhi. Experimental rotary breaker is in the process of installation. Orders for the procurement of equipment have been placed with the manufacturers and vendors, and efforts are being made to have the instrumentation package and the civil works underway.

Environmental studies: Investigations were carried out at the instance of BCCL, Cirrus Consultants, Vancouver, and Kolaghat Thermal Power Station, Kolaghat, GAI/MET Chem. Joint Venture and Min Mec Consultancy (P) Ltd, on the following projects: Quantification of respirable particulate matter in ambient air of coal mining area of BCCL (completed in September 1996); Traffic and emission survey for air quality evaluation studies in Jharia area (completed in July 1996); Assessment of the quality of stack emission and ambient air of Kolaghat Thermal Power Station (completed in March 1997); Monitoring of emissions from coal mines under fire (completed in August 1996); Environmental Impact Assessment of Kundra Kocha Gold Mine (initiated).

Behaviour of coal related to its physico-chemical make-up, petrographic composition and mineral association: Six different coals along with their petrographic components have been analyzed for their chemical, physical and petrographic composition at the instance of DST. For carrying out the petrographic analysis, an image analyzer with match-

ing software has been procured from Israel. All the coal samples have been separated into their organic and inorganic components and the X-ray and IR on the separated components done. For the ¹³C-NMR analysis, samples have been sent to Indian Institute of Science, Bangalore. For improved XRD and Thermal analysis, samples have been sent to VECC, Calcutta; IIT, Calcutta; Regional Research Laboratory (RRL), Bhubaneswar; and Indian Lac Research Institute (ILRI), Chatrapur, Orissa.

Studies on density and charge distribution in the coal model are being carried out with the help of molecular modeling software (Hyperchem Release 4.5), suggested earlier.

Beneficiation of thermal coals: At the instance of SSRC, investigations to predict beneficiation possibilities have been completed on five samples of coal from Talcher, IB-Valley and North Karanpura fields, using drop-breakage simulating rotary breaker operation and washability. Of the five samples studied, two responded to effective dry deshaling using rotary breakers. The results indicate that response to selective crushing and deshaling vary widely from sample to sample.

Revamping and modernization of Dugda washery laboratory: Advice has been rendered at the instance of BCCL, Dhanbad, for revamping the laboratory, which was inadequate by modern standards. Efforts are continuing to modernize the laboratory to bring it in conformity to ISO requirements.

Ash utilization: Investigations for the utilization of ash in agriculture included: Bulk scale utilization of coal ash from Bakreshwar TPP in agricultural lands (Department of Science & Technology, Bakreshwar

Thermal Power Plant); Bulk scale utilization of coal ash from Farakka STTP in agricultural lands (Department of Science & Technology); Bulk scale utilization of coal ash from Chandrapur power station (Maharashtra State Electricity Board, Mumbai); and Utilization of lignite ash for agriculture (SSRC).

With the completion of two pilot field experiments extended over a period of two years to establish the use of fly ash as a soil conditioner at Bakreshwar and Farakka, the Department of Science & Technology, Government of India, as part of the National Fly Ash Mission programme, has supported the extended studies at these two sites covering roughly 2 hectares each. The earlier findings had established the improvement in various physico-chemical properties of soils leading to an increase in the yield of various crops like paddy, wheat, etc., ranging from 20 to 60%, with the use of fly ash up to 200 tonnes per hectare. No evidence has been found on uptake of heavy metals in the plants.

The laboratory is now fully equipped with Milenium Ion Liquid Chromatograph System (Waters), Microwave Digestion Unit (Pro-labo), Hydraulic Conductivity Test Kit (Eijkelpkamp), Millipore Demineralized Water Plant (Waters), and Ion Analyzer (Orion), etc. for undertaking detailed and systematic investigations in the area of solid waste management and associated environmental problems.

Processing of heavy residue: Under this project, taken up at the instance of IOC R&D Unit at Faridabad, solvent dosing optimization has been completed. Evidence of higher conversion in the product obtained at $<600^{\circ}\text{C}$ has been observed with an increase in solvent

dosing up to an optimum level. Pressure has been found to have practically little effect on the conversion to the desirable product ($<600^{\circ}\text{C}$) state. Designing of the continuous reactor system based on the work carried out in the batch process has been completed. Fabrication of the reactor system based on above design is under progress.

Utilization of syn gas from coal—Synthesis of higher olefins through oligomerization of olefins from syn gas: Promoted and calcined iron titania (from different source materials and based on pillared clay) have been prepared and tested for synthesis gas conversion to lower olefins at the instance of SSRC. Maximum selectivity achieved for $\text{C}_2\text{-C}_4$ olefins is 60 wt%. The yield is 40-50g $\text{C}_2\text{-C}_4$ olefins/ nm^3 of syn gas converted. These results are comparable to international standards. Five new generation solid acid catalysts have been prepared and sent to Indian Petro Chemicals Ltd (IPCL), Baroda, for oligomerization of lower olefins to higher olefins.

Synthesis of higher alcohols from syn gas: A collaborative project with the University of West Virginia, Morgantown, USA, has been undertaken with financial support from USAID, for the development of a catalyst and process to convert synthesis gas to higher alcohols ($\text{C}_1\text{-C}_6$). These higher alcohols are to be used as a substitute for tetra ethyl lead as gasoline additive.

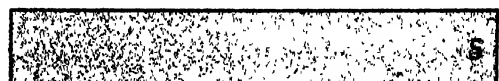
Development of pyridine-based chemicals: Following a laboratory demonstration on the catalytic conversion of 3-cyanopyridine to nicotinamide (20 g per batch), successful pilot demonstration on 50 kg per batch was given to Dhampur Sugar Mills (DSM) at their Lucknow site. Catalyst life, various

analytical methods and laboratory data have been completely replicated in the pilot plant. Based on these studies, DSM has now finalized the commercial design of the nicotinamide project with a capacity of 1 tonne/day.

Coal water slurry as an alternative fuel: A single-step grinding process has been developed on 30 kg batch scale, for the preparation of High Concentration Coal-Water Slurry (HCCS), which can be used as substitute fuel in retrofit oil-fired appliances. The results of the studies carried out with coals from North-eastern region of India indicate that the single-step wet grinding process provides a distinct advantage over dry grinding in respect of milling time and slurry viscosity. The shelf-life of such slurry also shows improvement from seven to twenty days resulting in the development of a simple but effective circuit, leading to a unit which is less capital intensive and easy to operate on a smaller scale for producing HCCS up to 70% solids loading. Such units may be specially suited to provide HCCS as an alternative fuel in medium and small-scale industries using fuel oils.

An attempt was also made to develop a model for the coals used (ash below 10%) to predict the slurry viscosity with respect to coal loading and coal characteristics in terms of dry ash, hygroscopic moisture, water holding capacity and oxygen (daf) content. A linear relationship was obtained, and the experimental data fitted very well with the predicted data in the range of 65-70% coal concentration in HCCS having correlation coefficient of 0.99.

Slurry atomization tests were carried out in a twin flow, externally mixed, single discharge port, cen-



trally placed slurry atomizer capable of atomizing slurry at a rate of 30 kg/h. The pressure of atomizing air was 8 kg/cm². Mass median diameter (MMD) of the slurry droplet was found between 70 and 100 μ .

Combustion test of slurry was conducted in an oil fired reheat furnace which was suitably modified to accommodate coal water slurry burner. Smooth and sustained combustion of slurry was observed at a furnace temperature of 900°C and above.

Apart from the optimization of process parameters for generating desired particle size distribution, the heart of the technology is the additives. As most of the systems are proprietary in nature, the work is oriented towards development of such additives.

Coal tar additives for coal water slurry fuels: Under a study being carried out at the instance of SSRC, conditions for sulphonation of coal tar products like naphthalene, toluene and phenol have been established from which long-chain anionic additives will be prepared and evaluated for their utility in preparing stable coal water suspensions for use as a fuel oil substitute.

Ovens for soft coke: Based on the successful modification of the Delta Enterprise, Dhanbad's coke oven, a new design has been standardized, according to which a battery of eight ovens has been set up. The capacity of the oven is 2 tonnes per batch with a maximum residue time of 12 h. The energy efficiency is 79%. The technology is being offered to industry now. Two such plants are under construction. Till the end of the year, 50 parties had deposited part payment for obtaining knowhow and were awaiting coal linkages to be established.

Installation of coal slurry flotation plant: Basic flow-sheet with equipment specification and information on the prospective suppliers have been provided to M/s Jai Ma Kali Udyog Ltd, Dhansar, Dhanbad. Major equipment have been inspected and erection work is in progress.

Technical audit of tar acid recovery units and gas retorts of Dankuni Coal Complex: With a view to optimizing the production of tar acids and also upgrading the quality of saleable fine chemicals, viz. phenol, *ortho/meta/para*-cresols, xylenols and high boiling tar acids (HBTAs), the work on technical audit of tar acid recovery units has been undertaken for South Eastern Coalfields Limited (SECL), Bilaspur. The most significant achievement of this study is the qualitative improvement in the production of these saleable fine chemicals. Modifications have also been suggested involving Rs 0.7-0.8 million one time expenditure, resulting in increasing the net earnings by Rs 1 million and also additional savings in manpower and energy.

Lignite Utilization: The investigations included: Beneficiation study on lignite desulphurization [Rajasthan State Mineral Development Corporation (RSMDC), Jaipur]; Technical feasibility studies on desulphurization of lignite for cement industry [National Council for Cement & Building Research (NCB), Faridabad]; Development of a devolatilizer for lignite (RSMDC); and Fusion characteristics of ash of Rajasthan lignite (RSMDC). The basic objectives of these investigations were to reduce the sulphur content, improve the quality of lignite as energy source, and enhance the ash fusion characteristics of the material for industrial applications.

NCB and RSMDC have shown interest in utilizing the lignite deposits of the region as an energy source for cement and other industries. As a result, the above four projects have been pursued. The basic objectives are to: (i) reduce the sulphur, (ii) improve the quality as energy source, and (iii) enhance the ash fusion characteristics for industrial use. Besides crushing and selective classification as a means for sulphur reduction, desulphurization with air and steam of sulphur rich fraction was attempted; 20 to 30% reduction in sulphur has been achieved.

Three lignite samples of Giral mine in the Barmer district of Rajasthan, i.e. seams 1, 2 & 5 and one sample each of bauxite and dolomite received from RSMDC, for laboratory scale studies for the improvement of fusion characteristics have been characterized and lignites tested with different proportions of bauxite as antilflux. Samples of Seam 1 & 2, with initial deformation temperature (IDT) 1070°C and 1060°C respectively under MRA, have shown improvement in respect of IDT to above 1200°C with increase in ash percentage from 7.8 to about 10.0 for Seam 1 and from 22.7 to about 29.0 for Seam 2. Studies for Seam 5 lignite samples are in progress.

Identification of coal tar source for carbon fibres: At the instance of Indian Space Research Organisation (ISRO), Thiruvananthapuram, a project to identify an indigenous source and establish a process for the enrichment of mesophase in pitch for speciality applications has been undertaken. Quality of tar available in India in respect of QI (quinoline insoluble) is not suitable for the production of mesophase pitch. However, the tar after processing,



i.e. after reduction of QI, would be suitable for the production of mesophase pitch. During studies at CFRI, the level of QI content in the tar could be reduced to the extent of more than 99%. Investigations on the production of mesophase pitch were conducted with the processed tar pitch (QI ranging from 0.2 to 3.55%) under different conditions of time, temperature and pressure.

Feasibility report on the potentiality of calcined and raw petroleum coke for production of briquette fuel: At the instance of Indian Oil Corporation, Faridabad, assessment of physico-chemical properties of cured briquettes was done and it was found that briquettes produced from CPC (x3mm) and coke breeze (x3mm) mix (10:90 and 20:80) with asphalt as binder (7.0%) are quite strong, having point crushing strength 290 kg and 323 kg and their respective M₄₀ and M₁₀ values 95.0, 5.0 and 92.7, 7.5. No appreciable improvements were noticed by increasing the amount of CPC in the briquetting blend. In case of briquetting RPC (x3mm) by increasing the percentage of sludge and lowering the percentage of asphalt in the briquetting blend, no encouraging results were obtained, perhaps owing to non-functioning of sludge as binder.

Pricing of washed coal: A model has been suggested to BCCL, Dhanbad, for price fixation based on petrographic and chemical analyses linked to the effect on performance.

Studies on the improvement of 'chulha' for efficient combustion of coals: These studies were carried out for the Ministry of Non-conventional Energy Sources (MNES), Government of India, New Delhi. Efforts

were made to popularize the models 'Angarmitra' and 'Angarbandhu' *chulhas* through demonstration, training and distribution of samples to various organizations. The usage of CIL coke in 'Angarmitra' was found to be suitable. A new portable model of mini community *chulha*, using soft coke has also been developed.

Removal of arsenic from drinking water in West Bengal: CFRI as a part of multi-laboratory project initiated by the Technical Advisory Board (Physical & Earth Sciences), carried out preliminary investigations on removal of arsenic from water, found in excess of the permissible limit in Murshidabad district of West Bengal. □

A rare sea cucumber, *Pseudocolochirus violaceus*, found off Poompuhar

DURING one of the marine archaeological explorations off Poompuhar, a team member from the National Institute of Oceanography (NIO), Goa, Shri Umesh Shirsat located a colourful organism at the subtidal region (19 m), which was later identified to be a rare cucumber.

This is one of the most bright coloured and a rare sea cucumbers. The body is dark violet. The tube

foot rows and the tentacles are bright yellow. With the help of tentacles these animals select the sand particles (deposit feeding type) which are high in detritus content as food.

A century ago, it was reported from India by Theel, 1886 (A report on the Holothuroidea dredged by H.M.S. *Challenger*, during the year 1883-86) and recently by CMFRI, 1979 from Gulf of Mannar. □



Pseudocolochirus violaceus, a rare sea cucumber, collected from subtidal region of Poompuhar

Mini Refineries in Indian Context

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THE concept of a mini refinery is to convert small quantities of the crude oil, available mainly from small oil fields located in remote areas, into petroleum products like kerosene, diesel and fuel oil to cater to the local demands. The mini refinery, which is usually designed to process 1000 to 10,000 barrels per day (BPD) (0.05 to 0.5 MMTPA) of crude oil, is self-contained, skid-mounted, low-cost, low-maintenance unit requiring no utilities like process or cooling water, electric power, etc.

Applications

The two major applications of the mini-refineries are

1. *Remote Oil Fields:* In Indian context, there are many remote areas in the regions of Assam, Gujarat, Andhra Pradesh, etc. where many small oil fields are available without adequate port or pipeline facilities to carry the crude to the oil processing centres, owing to economic reasons. In such cases, the crude oil has to be transported to the nearby refinery by road and in turn, the petroleum products are brought back (from the refinery) for the use of local residents. For example, the crude produced at RAWA oil field located along the long coast line of Andhra Pradesh is brought to Vishakhapatnam at Hindustan Petroleum Corporation's refinery by road, in the tankers. The transportation cost is estimated to be about Rs 500 per tonne. The petroleum prod-

ucts are also brought back to the region by road by spending an equivalent amount of money. It would be economical if the mini-refinery is installed in the vicinity of the oil field for delivering the refined products to the end customers in the market immediately surrounding the oil-field and thus eliminating the crude/product transportation, transit losses and environmental problems.

2. *Energy Requirements:* In small towns located near the oil fields, trucks have to be put to use to bring the fuel over long distances for running the power turbines for electricity generation. The fuel oil produced from mini-refineries of simple configuration (having a distillation column without any blending or secondary processing units) has low sulphur content and is ideal in setting up the small power plants to cater to the local needs. It has become more logical in the present context where the government has given its consent to use such liquid fuels by States for setting up small power plants, on priority at par with co-generation plants, with an envisaged capacity of up to 12,000 MW under one-time measure scheme for the power industry.

Advantages

There are several advantages in opting for a mini-refinery e.g.:

- The remote/inaccessible site can be used for installation of a refin-

ery with a flexibility for accommodating broad range of feed stocks available in the region.

- Since the mini-refineries, consisting of different modules, are joined at site, these can be easily dismantled for transportation to other areas, in case the oil field, where it was installed initially, gets exhausted.
- Owing to heavy reduction in the production schedule and manpower density by performing sequential activities in parallel and indoor environment, use of remote site, etc., the overall project cost is substantially reduced.
- Since the modules are not of very great height, there is an increase in productivity and safety because of working on the ground.
- The basic design is so unique that there is no need for process or cooling water, electric power and any other support utilities.
- It has the special features that enable efficient start-up and shut-down.
- All the required power is generated internally by a generator designed for continuous and reliable service.
- By selecting an appropriate crude, all the products can straightaway be used without blending or further processing.
- The mini-refinery may be designed and operated to cause the minimum environmental impact by impounding the wastewater from the accumulator in a slope



tank, burning all stripped gases as fuel in the column feed heater or in the drive engine for electric power generator, etc.

Plant Description

The plant consists of the most up-to-date and modern mini-plant technology, enabling it to function with a high degree of automation and computer control for all process functions including shut-down upon detection of a hazardous condition and re-start after correction for the abnormal situation, using a broad range of feed-stocks to handle either stabilized or unstabilized crudes of low/high API gravity.

The crude oil from the well-head is flashed (after pumping through filters, heat exchangers and feed heaters for removal of particulate matters, preheating, etc.) into the column-still where it is fractionated into light ends (vapours), naphtha, kerosene, diesel and fuel oil. Light ends are collected and used as fuel gas in the fired heaters for internal use. Naphtha, low in octane, may be used internally (partly) or in fertilizer industry since it has normally low sulphur and aromatics. Kerosene (having low sulphur and high smoke point) and diesel (having low sulphur and high cetane number) are straightaway used or can even be blended with inferior products. Fuel oil (low in sulphur) can be used for generation of power.

Such a plant can be mounted onto a number of skids of approximately 10'x 10'x 40' size. The total area required for the plant having a capacity ranging from 1000 to 10,000 BPD, varies from about 2 to 6 hectares.

Production Schedule and Investment

Units of capacities ranging from 1000 to 10,000 BPD (0.05 to 0.5 MMTPA) can be commissioned in 12-18 months. The upfront initial investment for equipment and off-sites for a 1000 BPD (0.05 MMTPA) capacity mini-refinery of simplest configuration (having a distillation column without any blending or secondary processing units) is about 6 million dollars including the working capital, which is normally for 5 days in such small capacity modules. The refinery of same configuration having 10,000 BPD (0.5 MMTPA) capacity would require about 26 million dollars as upfront initial investment excluding the working capital and interest charges.

Mini refinery Economics

The economics has been calculated for processing 10,000 BPD (0.5 MMTPA) RAWA crude using the administrative pricing policy mechanism (APM) of products (revised basic ceiling selling price ex-storage point exclusive of excise duty, etc. as of June 1996) and crude oil costing 22 dollars per barrel.

Assuming the disposal of naphtha, kerosene and fuel oil in industrial market/non-fertilizer industry (i.e. without government subsidy), the initial projected cash flow is about \$18.5 million per year (\$ 9.5 million after taxes) for a project with an investment of about \$ 26 million plus working capital and interest. Thus, the payout period is reasonably fast and the return quite good. In case the products are used by the vulnerable sections of the society in that region, i.e. sold to the customers at subsidized rates (even below the cost of production), the return is

allowed at 12% post tax on the average net worth and interest on adjusted borrowings (net fixed assets plus 35/45 days value of crude throughput).

Crude Oil Potential

The crude oil potential, based on the crude assay available at IIP shows that crudes which are being explored from small oil fields like the Kharsang Mix (Arunachal Pradesh in North-East Sector), RAWA (Godavari basin, Andhra Pradesh), Ankleshwar-Gandhar Mix, Indora & Bakrol (Gujarat), etc. have a large potential for such mini-refineries. Kerosene and diesel produced from these specific crudes can be utilized straightaway (without blending or further processing) or can even be blended with inferior products before use.

IIP's collaboration with a US-based Company

IIP has tied-up in June '96 with the US-based NRI company, the Unitel Technologies, Inc. (UTI), to design and erect mini-refineries in India, by involving the Val Verde International, USA, who are world technological leaders in small-scale modern modular processing mini-refineries on turn-key basis. IIP having a database of various crudes, will extend its services to assay the crude (if necessary) and carry out the feasibility studies with participation in process and detailed engineering design of the plant, followed by its installation, commissioning and trouble-shooting. The mini-refinery modules may be engineered/fabricated either in India or at a facility in Houston, depending upon the economics of a particular application in India. However, the

infrastructure and Off-Site Battery Limit (OSBL) will be done by the Indian parties. UTI has also engaged the Zapata Energy for arranging the

financial assistance, if required by the client, from US-EXIM Bank and other sources on low interest rates. □

CBRI Golden Jubilee Conference

Natural Hazards in Urban Habitat

As a part of its Golden Jubilee celebrations, the Central Building Research Institute (CBRI), Roorkee, organized a two-day conference on 'Natural Hazards in the Urban Habitat' in New Delhi, during 10-11 November 1997. The conference was attended by 135 delegates including five from Sri Lanka and one from USA. Most of the delegates were from research institutes, IITs, universities, government departments and social service organizations. The inaugural session was attended by about 200 delegates and guests. The session started with the welcome address by Prof. R.N. Iyengar, Director, CBRI, who gave an introduction to the theme of the conference, highlighting CBRI's work in the area of disaster mitigation. Since most of the

present stock of buildings in the cities are vulnerable to natural hazards, Prof. Iyengar emphasized the need for a planned mitigation strategy to avoid large-scale destruction.

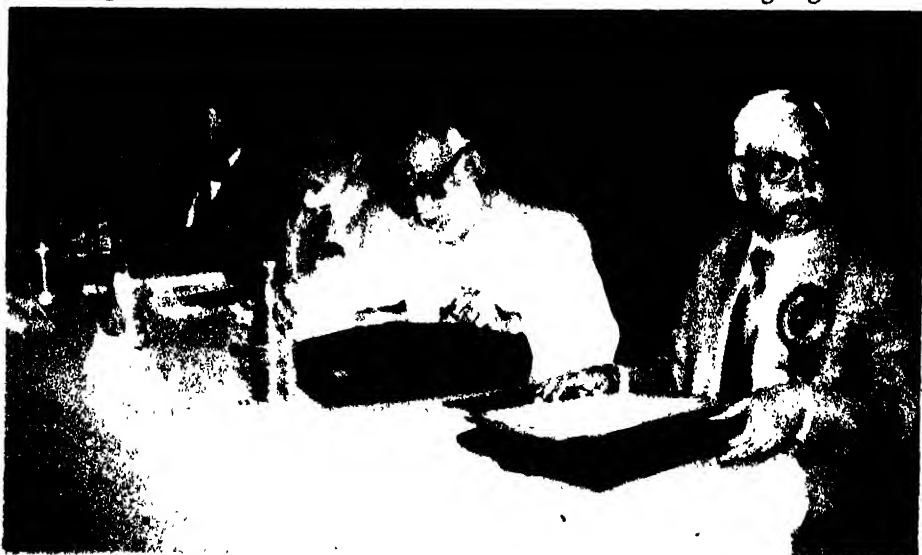
The conference was inaugurated by Dr M.R. Srinivasan, Member, Planning Commission. In his address, Dr Srinivasan emphasized that management of natural hazards is a multidisciplinary work and has to be tackled with inputs from experts in different fields. He advocated a shift of emphasis from post-disaster reactive approach to pre-disaster proactive approach.

The keynote address was delivered by Prof. M.G.K. Menon, former Minister for S&T, Government of India. In his thought provoking address, Prof. Menon highlighted the

adverse effects of population migration into urban centres and the problems caused by over exploitation of natural resources. He proposed a more integrated approach in identifying the high-risk zones. For enhancing safety against natural hazards, Prof. Menon advocated formulation of codes, standards and bye-laws on disaster-resistant construction at an acceptable level and their effective implementation at grassroot level.

Apart from the inaugural and concluding sessions, the conference had five technical sessions. Chaired by Mr C.H. de Tissera, Director General, National Building Research Organisation, Sri Lanka, Session I had four invited talks by eminent experts in the area of disaster mitigation. In his talk, Shri V. Suresh of HUDCO highlighted the role of his organization in disaster mitigation. Lessons from scientific study of Indian landslides was the topic of talk by Dr R.K. Bhandari, Head, ISTAD, CSIR. Dr S.K. Chaudhuri of the Central Water Commission discussed flood disaster management for urban areas. Sulabh technology for sanitation improvement in urban habitat was presented by Dr Bindeswar Pathak of Sulabh International.

Devoted to landslides, Session II had five papers and was chaired by Shri Bhagat Singh, Central Relief Commissioner and Additional Secretary in the Ministry of Agriculture, Government of India. Session III had three invited talks in the area of earthquakes and one on landslides. It was chaired by Dr V.C. Thakur, Director, Wadia Institute of Himalayan Geology. Four papers on earthquakes were presented in Session IV, chaired by Shri Chandra Pal, Additional Director General, CPWD. Shri P.B. Vijay, former Director General, CPWD, chaired Session V. The session had one invited talk and



Seen during the CBRI Conference on 'Natural Hazards in Urban Habitat' (from left) are: Shri M.P. Jaisingh, Organizing Secretary; Prof. R.N. Iyengar, Director, CBRI; Prof. M.G.K. Menon, former Minister for S&T, Government of India; and Dr N.S. Bhal, Dy. Director, CBRI



four papers on natural hazards including earthquakes and cyclones.

The concluding session had panel discussion under the chairmanship of Prof. R.N. Iyengar, Director, CBRI. Shri O.P. Goel, former Director General, CPWD; Shri D.S. Meshram, Chief Planner, TCPO; Shri S.D. Garg, Head, STMD, CSIR; and Shri K.R.S. Krishnan, Principal Research Officer, DST were the panelists. Draft recommendations of the conference were discussed in detail by the panelists and the delegates, before these were finalized and adopted by the conference for further action. The observations/recommendations are:

1. A shift in emphasis in planning of mitigation of natural hazards from the post-event relief measures to pre-event preparedness is called for.

2. Keeping in view the fast growth of towns and cities along the coast and in the mountainous regions, special mitigative policies and action plans need to be formulated to guard against geo-climatic hazards such as sea level changes, flooding, cyclones, ground subsidence, cloud bursts and landslides.

3. The occurrence of four destructive earthquakes in quick succession in the last ten years underscores the widespread vulnerability of the country to the earthquake hazards. Action on microzonation of big cities, retrofitting of vulnerable building stock and other recommendations made by the B.K. Rao Committee appointed by the Government of India in the wake of the 30th September 1993 Latur (Maharashtra) earthquake, be started immediately. Ministry of Agriculture, MUA&E, MRA&PA, DST and other agencies are called upon to take action on these points.

4. It is recognized that proper education and training are the best

allies in disaster prevention. It is recommended that in the formal education sector, both technical and humanities, suitable new subjects be introduced in the curriculum at all levels to create a new generation of manpower, well equipped to handle natural hazards.

5. Dissemination of information is an essential aspect of mitigation. A national clearing house supporting information on all aspects of natural disasters be started, preferably at an institution of higher learning with Internet access.

6. Experience from the last few disasters has shown that the effect of hazards are amplified due to poor

implementation of known mitigation measures. Appropriate technological framework should be evolved to ensure better compliance with recommended best international practices.

7. The Government of India may establish a National Board of Hazard Preparedness and Disaster Mitigation, to deal with all aspects of early warning systems, hazard preparedness, disaster mitigation, training, education, S&T activities such as microzonation & modelling, information collection, etc. and to evolve guidelines and protocols for coordination between agencies concerned. □

WORKSHOPS

International Workshops on Viable Alternatives to OD Solvents

THE adverse effect of ozone layer depletion has led to world wide human health and environmental concerns, resulting in a number of international treaties and protocols. The Montreal Protocol is the force behind the phase-out operations of Ozone Depleting Substances (ODS). The World Bank, UNEP, UNIDO and National agencies have developed strategies for the phase-out of ODS. The Ozone Cell, Ministry of Environment and Forests, is the Indian nodal agency. The Technical and Economic Assessment Panel of UNEP has constituted several Technical Options Committees (TOC) to coordinate globally the implementation programme in the important industrial sectors. The TOC for Solvents, Coatings and Adhesives (STOC) is one such committee, specially entrusted with the task of promoting and monitoring the phase-out activities in relevant sectors.

While industrially developed countries have already phased out ODS, developing countries including India are at various stages of implementation of the programme to meet the obligations of Montreal Protocol. At this juncture, it is necessary that Indian enterprises acquire good knowledge and information about the alternatives to OD solvents which have been developed and successfully adopted elsewhere in the world, to pick up the best suited alternative.

The Indian Institute of Chemical Technology (IICT), Hyderabad, which is well-known both nationally and internationally to chemical industry for its contributions to the area of chemical sciences, has taken initiatives for ODS phase-out programme in India and is actively participating in the programmes of UNEP's STOC, IICT on behalf of UNEP's STOC, organized two work-



Prof V.S. Ramamurthy, Secretary, Department of Science and Technology, Government of India, delivering his inaugural address during the International Workshop on 'Viable Alternatives to OD Solvents'. Sitting on the dais (from left) are: Dr A.A.Khan, Scientist, IICI & Convener of the Workshop; Dr M. Malik, Co-Chairman, Solvents Options Committee, Dr K.V. Raghavan, Director, IICI; Shri Anil Agarwal, Director, Ozone-Cell, MOEF & Dr R. Shende, Coordinator, UNEP-IE, Paris

shops on 'Viable Alternatives to OD Solvents' at Bangalore (15-16 October) and New Delhi (20-21 October). These workshops, with focus on electronic, precision and metal cleaning and aircraft maintenance, aimed to provide a comprehensive update on the technical options already developed. SME's specific needs and modalities to meet these requirements was an important sub-

ject for discussion in the workshop. Highly competent and knowledgeable experts from USA, Japan, Germany, Switzerland, UNEP and India, formed the faculty of the workshops. The workshop strived to provide necessary technical inputs to Indian enterprises in implementation of ODS phase-out programme. □

National Workshop on Use of Bitumen Emulsion in Road Construction — Problems and Prospects

THE Central Road Research Institute (CRRI), New Delhi, organized a National Workshop on 'Use of Bitumen Emulsion in Road Construction — Problems and Prospects' on 27 October 1997 as one of the events scheduled during the Golden Jubilee Year of the institute. The workshop was inaugurated by Shri Rajendra Gupta, Minister of Transport, Excise, & Judi-

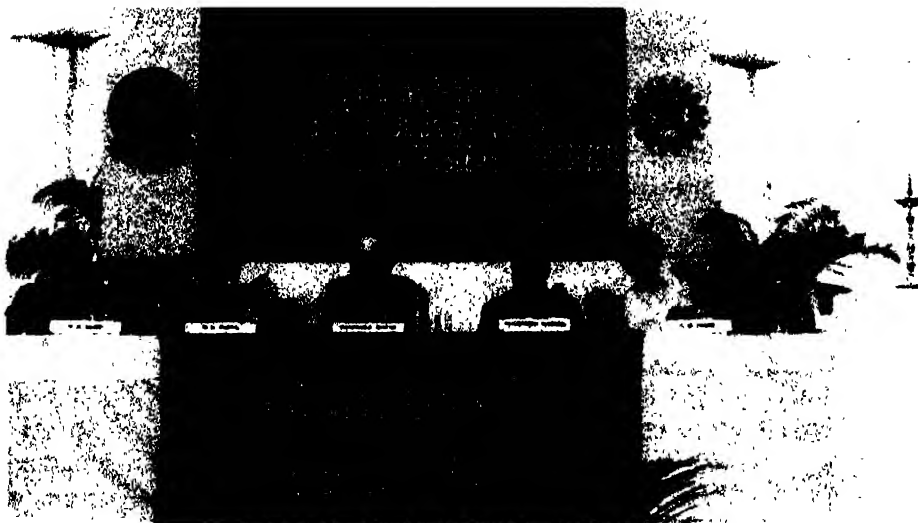
cial Affairs, Government of Delhi, and presided over by Shri Yogendra Narain, Secretary, Ministry of Surface Transport, Government of India. The workshop was supported by CSIR and DST and sponsored by several industrial units and user organizations. An exhibition was also arranged on the occasion, displaying the recent developments in equipment and technology in the

field of bitumen emulsion in road construction.

Shri Rajendra Gupta in his inaugural address mentioned that in view of the Supreme Court directives for shifting of hot-mix plants from Delhi, the use of cold mix technology, which is cost-effective and environment-friendly, will be encouraged by the government, in construction and maintenance of roads. He added that the environmental need has necessitated the use of cold mix technology, for maintenance and rehabilitation of roads, in all major cities of the country.

Shri Yogendra Narain, in his presidential address, mentioned about disadvantages of hot mix technology. Referring to the recent judgement of the Supreme Court of India regarding closure of hot mix plants from rehabilitated areas of Delhi, he added that the bitumen emulsion is a very promising binder and can be used even under adverse climatic conditions for a variety of purposes. He stated that it has now been made mandatory to use emulsion or cutback as binder for tack coat on National Highways, and appealed that all the state governments should follow suit. He hoped that it would be possible to use cold mix technology in a big way.

Late Prof. (Dr) A.K. Gupta, the then Director of CRRI, called it unfortunate that bitumen emulsion is not being used the way it should have been, as is in many other countries, in spite of its many advantages. The emulsion is energy-efficient, eco-friendly, causes no smoke or gas and can be used in any weather conditions. Speaking on the occasion, Dr S.M. Sarin highlighted the various programmes being organized by CRRI as a part of its Golden Jubilee celebrations. Shri V.K. Sood, Working Chairman, highlighted the future R & D needs in the



Seen on the dais during inaugural session of National Workshop on 'Use of Bitumen Emulsion in Road Construction — Problems and Prospects' (from left) are: Shri V.K. Sood, Prof. A.K. Gupta, Shri Rajendra Gupta, Shri Yogendra Narain, Dr S.M. Sarin and Dr P.K. Jain

area of emulsions and cold mixes. Dr P.K. Jain, Organizing Secretary, while presenting the theme paper, mentioned that there is not enough awareness about this technology amongst the professionals. He expressed that initially bitumen emulsion could be used for patch repair and preventive maintenance works.

The workshop had three technical sessions pertaining to quality,

specifications and design applications and case histories followed by panel discussion on future of emulsion in India. The expert speakers were: Dr L.R. Kadiyali, Shri S.C. Sharma, Shri P. Rajendran, Prof. S.S. Jain, Shri K.B. Rajoria, Prof. B.B. Pandey, Maj. Gen. (Retd) H.K. Kapoor, and Shri L.N. Narender Singh. About 150 experts from industry, R&D/user organizations dis-

cussed the key issues. The workshop provided a forum for a dialogue between those looking for solutions in the area of construction and maintenance of bitumenous roads and degradation of environment.

A business meeting on Industry-User Interactions was also organized on the occasion. Shri A.D. Narain and Dr H.R. Bhojwani addressed the delegates during the meeting.

The major recommendations of the workshop are:

- The use of emulsion should be enhanced, say up to a level of 10% of the bitumen consumption in India.
- Simple performance-based specifications need to be developed.
- A detailed research project on the lines of the first European Cooperation Project can be taken up in India.
- A construction manual on use of cold mixes is urgently needed.

It was resolved that the all routine maintenance henceforth shall be done by the cold mix technology. □

NBRI celebrates Annual Day

THE National Botanical Research Institute, Lucknow, celebrated its Annual Day on 25 October 1996. Dr C.R. Bhatia, ex-Secretary to the Department of Biotechnology, Government of India, presided over the function. Prof. G. Padmanaban, Director, Indian Institute of Sciences, Bangalore, and a noted biotechnologist of the country, delivered the Seventeenth Silver Jubilee Lecture, entitled 'Scientific and Ethical Implications of Gene Cloning'.

In his lecture, Prof. Padmanaban stated that gene cloning has become

a major industry in the area of diagnostics, production of protein pharmaceuticals, creation of new drug targets, gene therapy, recombinant and DNA vaccines. Equally impressive has been the developments in terms of application of biotechnology to agriculture and floriculture. Genetic engineering has been ushered in to improve agronomic traits (e.g. improving salt tolerance), pest and weed management (e.g. insect resistance using BT gene), plant breeding (e.g. male sterility), nutritional quality (e.g. high methionine and high lysine seeds), post-harvest qualities (e.g. delay of fruit ripening-

FLAVR-SAVR) and to resort to molecular farming (e.g. oil made to order, oral vaccines). Implications for the production of commodity chemicals, treatment of pollution, mineral processing and biocomputers, have rendered sky as the limit for innovative applications, he remarked.

Describing the other side of the coin, he said these mind boggling applications have also created concerns in terms of ethical and legal issues. For example, the major effort on human genome sequencing, which is being pursued with the purpose of understanding hot spots,

vulnerable to genetic disorders and other diseases, may lead to questions: Whether gene maps of individuals would form part of biodata in future, and if a population in any part of the world was found to be genetically defective for any character, would it lead to a new form of apartheid? And whether knowledge of prenatal diagnosis of genetic disorders would lead to its misuse? Mentioning about the recent achievement in the birth of 'Dolly' by cell cloning, which has raised visions of human cloning, he questioned, "Is human dignity trampled upon by human gene cloning? But on the other side, cloning one's own organ could be of great use in organ transplantation, and that gene therapy could be used to treat a genetic disorder or an infectious disease. It could also be used in eugenics. Commenting on the environmental consequences of releasing transgenic plants for field use, he asked, "What would happen if the disease resistance gene introduced into crop plants gets picked up by weeds and the latter took over?" Expressing his concern about the ethico-legal issues in terms of claiming intellectual property rights for commercially ex-

ploitable discoveries from living systems, he asked, "Why should biodiversity of a country be treated as a global heritage when biotechnology can become private property". But, despite all these discussions and arguments, countries are vying with each other to exploit this field for addressing issues of health and disease, food and agriculture, environment and industry, and it would not be pragmatic to get lost in ethical discussions to an extent of throwing the baby with the bath water, he said with a cautioned note.

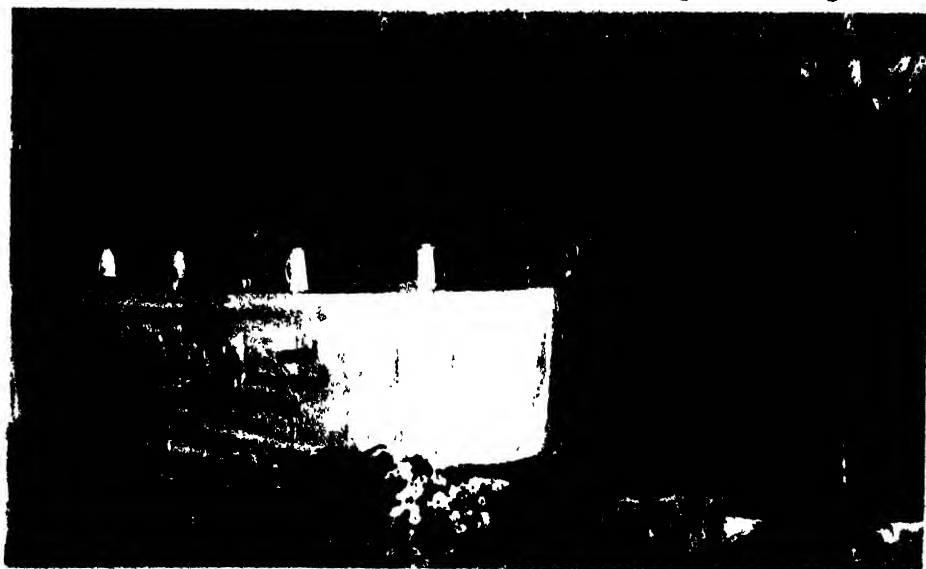
Prof. Padmanaban further said that progress in science and its implications could not be stopped in a global sense. "With trade barriers disappearing and economic liberalization setting in, it would be pragmatic to swim with the tide to reach a safe destination rather than be swept away to disastrous ends. The driving force ultimately has to be the preservation and prosperity of the human kind, living in a humane world. While, individuals and groups can be free to follow the dictates of their conscience in terms of bioethics, governments can only take a pragmatic view and facilitate exploitation of gene cloning with a

human face", he opined. He concluded with the remark "How human the face is a matter for judgement that can be debated for ever!"

Earlier, Dr P.V. Sane, Director, NBRI, welcomed the Chief Guest, Dr Bhatia and speaker Prof. Padmanaban and introduced them to the audience. He also presented the progress report of the institute.

Highlighting the work carried out during 1996-97, Dr Sane said that during that year the institute worked on a total of 45 projects belonging to six major areas of R&D. Of these, 16 projects are sponsored ones with financial support from different Departments. The major financial assistance through sponsored projects came from the Department of Biotechnology, he informed.

Describing the major achievements in the area of plant biotechnology, Dr Sane said that the work on the chloroplast genome organization in *Populus* resulted in sequencing of nearly 75% of the total chloroplast genome from *Populus*, and NBRI is the only institute in India that has done such extensive sequencing of the plant genome. Describing the project, 'Insect pest resistance in crop plants through endotoxin and the cowpea trypsin inhibitor (CpTI) gene transfer', he said that positive plants expressing CpTI gene were tested for resistance against *Spodoptera litura* and up to 50% reduction in weight gain was observed in larvae fed on transgenic tobacco leaves. "Besides Bose Institute, NBRI is the only institute which has progressed so much in developing transgenics up to fourth generation successfully", he added. He further told that the coat protein gene of tomato leaf curl virus (TLCV) has been expressed successfully in the transgenics and the transgenic cot-



During the NBRI Annual Day Celebrations, sitting on the dais (from left) are: Dr P.V. Sane, Prof. G. Padmanaban, Dr C.R. Bhatia and Dr B.P. Singh



ton lines resistant to leaf curl are expected to be generated in the next 3-4 years. The prestigious multi-institutional programme on the development of transgenic Indian cotton lines that will be resistant to bollworms has made excellent progress. Under this project, a facile, one-step method developed for the assembly of oligonucleotides to synthesize double stranded DNA has been successfully applied for the synthesis of a gene for larvicidal protein δ -endo-toxin. A 1927 BP long gene designed for high level of expression in plant cell has been synthesized and cloned in a plant expression vector. It is the first time that such a long gene has been synthesized in the country and is a technological achievement by world standards. The assessment of genetic diversity of *Amaranthus*, *Neem* and *Prosopis* has been carried out using molecular techniques, such as DNA finger printing and RAPD. The studies on random amplified polymorphic DNA on several accessions of *neem* have provided valuable information on the biodiversity of this important medicinal tree species.

The Plant Molecular Virology Group has made attempts to prepare constructs of tomato leaf curl virus (TLCV) coat protein gene in front of cauliflower mosaic virus promoter for higher expression. Tobacco transgenic plants are being checked for expression of the coat protein gene in regenerated transgenic tobacco plants. The coat protein gene of TLCV has been expressed successfully in the transgenics as revealed by PCR detection. This group is also maintaining different strains of a new emerging devastating virus, i.e. cotton leaf curl virus (CLCV), maintained in glass house condition. A PCR-based technology has been developed to detect CLCV re-

liably. The tissue culture group has succeeded in growing one mm long shoot meristems of field grown tree of two commercially most important citrus species by *in vitro* strategies. An *in vitro* strategy has been developed to obtain flowering plants of a miniature *Chrysanthemum morifolium* 'Haldighati' during the extremely off season of April-May, he elaborated.

Highlighting the work of floriculture area, Dr Sane said that this institute had been in forefront to popularize floriculture in this part of the country. The scientists of the floriculture group have introduced many new cultivars of gladiolus, tuberose, gerberia and small and large chrysanthemums to enrich further the germplasm collection. This institute has successfully developed 'No Pinch No Stake', mini chrysanthemum group in addition to a wide range of new flower colour and type varieties through indiscriminate intervarietal hybridizations and selection. The mini varieties have been found to be very good material for landscaping also and one such landscaping on India map has been prepared depicting all states by different colour combinations. An RT-PCR based system has been developed to diagnose and detect polyviruses in bulbs and vegetative propagating materials of gladiolus, amaryllis, narcissus.

The Tissue Culture Group has developed an *in vitro* strategy to obtain flowering plants of a miniature *Chrysanthemum morifolium* 'Haldighati' during the extremely off season of April-May, he said.

Narrating the findings of Environmental Botany Group, Dr Sane informed that the pollutant concentration as well as traffic load of the urban sphere of Lucknow city has

increased since 1995-96. Certain plant species like *Ficus religiosa*, *Alstonia scholaris*, *Holoptela integrifolia*, *Dalbergia sissoo* and *Polyalthia longifolia* are good accumulators of lead and sulphate. Of the ten water bodies including five man-made, studied under the project entitled 'Investigation on methane emission from water bodies', Gomti river has been found to give maximum methane emission in all the seasons while minimum was recorded in Surajkund. "The data also indicate that methane efflux was many-folds higher from the vegetated surface than from the investigated surface of the same wetland", he said. He further said that the *Scirpus lacustris*, *Phragmites karka* and *Bacopa monnieri* were able to accumulate substantial amount of chromium during a short span of one week.

Highlighting the work of the Plant Wealth Utilization area, Dr Sane said that a compound hepatoprotective formulation has been prepared in the laboratory and standardized.

The Plant Breeding Group continued their efforts to improve the cultivars of opium poppy. Two NBRI varieties NBRI-9 and NBRI-10 were tested in All India Co-ordinated Trial for two years and both have been found to be significantly superior to National checks. *Cuphea*, an excellent natural source of oil seed crop for capric and caprylic acid, which were found in petrochemicals, has been introduced and acclimatized. NBRI is perhaps the first research centre to take up this novel crop for domestication in the country, for development of desired plant types. Another group of scientists worked out the standard procedure for the extraction of water soluble colours from *anar* rind

(*Punica granatum*) and onion scale (*Allium cepa*).

The Tree Biology Group has perfected nursery technologies for several horticulture and woodfuel tree species, and the achievements in clonal propagation of neem, guava and sheesham have led them to have a turn-key contract cum consultancy project from a World Bank-assisted programme.

The Microbiology Group has discovered bacterium called *Pseudomonas fluorescense* that prevents plant disease and boosts crop growth. This could become a money spinner as it can be utilized as a biofertilizer. This biofertilizer is ecofriendly unlike chemical fungicides and fertilizers.

The Plant Taxonomy and Biodiversity Group has made extensive field surveys in the Kumaon Himalaya for assessment of biodiversity and interspecific variation among two reputed medicinal plant genera, viz. *Aconitum* and *Podophyllum*, due to their dwindling population in view of their over exploitation by local people. The field and herbaria studies have shown that only five species of *Aconitum* are found in U.P. Himalaya. A new project on the floristic studies and assessment of biodiversity in the Tons Valley of Garhwal Himalaya, Uttar Pradesh, has been initiated as the valley exhibits enormous diversity in its flora. The International Legume Database and Information Service (ILDIS) in its Phase I established a world database giving basic data and agreed Taxonomic reference system for all legume species worldwide. In view of the institute's commendable performance in database development, Department of Biotechnology, Government of India, has awarded a grant of Rs 2.5 million to establish/undertake Phase-II modules of ILSIA South Asia Bioinformatics Centre as a National Facility to be

linked to DBT's network for supplying information from ILDIS database, Dr Sane informed.

"NBRI filed three patent applications in India and three in USA. The scientists of the institute pub-

lished 107 papers, 13 books/chapters in books, 4 review articles, delivered 31 popular lectures and presented 65 papers in various symposia, seminars/conferences", he concluded. □

COUNCIL OF SCIENTIFIC AND INDUSTRIAL RESEARCH

POSITION: DIRECTOR, CENTRAL MINING RESEARCH INSTITUTE (CMRI), DHANBAD

CSIR is seeking to appoint a Director for its Central Mining Research Institute (CMRI), Dhanbad. CMRI is devoted to carry out R&D activities in the field of rock mechanics, mining methods, mine environment and safety; to develop mine machinery equipment and instruments to make mining safe, productive, environment-friendly and economical; and to develop ways of reducing environmental pollution due to mining and minimizing health hazards to miners. The major R&D programmes of the institute relate to development of mining technology for the exploitation of complex coal deposits and total packages for optimal exploitation of mineral deposits other than coal; numerical modelling of rock excavation and computer application in mine planning and design from stability and safety points of view, development of underground space technology and technology for construction of tunnels, dams and caverns. The institute has two field centres: at Nagpur and Roorkee.

The institute has an annual budget of about Rs 650 lakh and S&T staff of approximately 450, out of which about 125 are scientists.

The Director serves as the Chief Executive of the institute and would be responsible among others for:

- Developing and managing a perspective plan for the institute
- Providing scientific leadership to the diverse R&D groups;

- Day-to-day operations of the Instt. and man-management;
- Promoting inter-laboratory and inter-agency R&D programmes and mission;
- Negotiating and acquiring R&D grants/contracts;
- Ensuring linkages with user agencies, including universities and industries; and
- Marketing the knowledge-base of the institute.

The candidate for the post must be a creative, innovative and well-established scientist/technologist of distinction and should be preferably around 50 years of age. He should have a broad scientific and technical vision, a demonstrated ability to create an environment conducive to nurturing of high class research and development, a proven record of inter-personal skills and an ability to communicate effectively.

This is a contractual appointment for a period of six years or superannuation whichever is earlier, in the scale of Rs 5900-200-7300 (under revision) plus allowances as admissible to Council officials. Contract can be extended for another term in exceptional cases. Consultancy is permitted without any ceiling on the annual consultancy remuneration. Residential accommodation would be provided as per rules on payment of prescribed licence fee.

**NOMINATIONS FOR THE POST
MAY BE SENT BY 30 January 1998.** □

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Regional Research Laboratory (RRL), Bhopal's R&D activities (Clockwise from top left): A multigravity separator installed at Rajpura Dariba mines of Hindustan Zinc Ltd, based on the RRL's studies; Magnetic particle test being performed for integrity evaluation of a structure; Rolled sheets of silicon carbide whisker reinforced aluminium alloy composite; and SiC whisker reinforced 2014 aluminium alloy matrix composite billets produced from ingots ready for extrusion. A report on R&D accomplishments of the laboratory appears on p 18.

REGIONAL RESEARCH LABORATORY, BHOPAL

R&D Highlights: 1996-97

THE Regional Research Laboratory (RRL), Bhopal's R&D activities are grouped under the following major disciplines: Building Materials, Metallurgy and Materials Science, Minerals, Resources Development and Environmental Sciences. During 1996-97 the laboratory pursued 51 projects (including 23 new ones) sponsored by various organizations/industrial outfits. Twenty of these projects have been completed. The ECF receipts of the laboratory through sponsored/consultancy assignments, etc. rose from Rs 19.828 million during 1995-96 to Rs 24.809 million during 1996-97. The major sponsored assignments undertaken during the year include the one for the State Directorate of Sericulture, on irrigation management in sericulture farms. The work involved water management in selected sericulture farms and development of irrigation potential in Rajgarh, Bilaspur and Sarguja districts of M.P. Also, a watershed development project is being implemented in Raisen District under the Rajiv Gandhi Mission of Watershed Development launched by the State Government. In the area of building materials, work was continued on wood substitutes, flyash bricks, mineral wool panels and integrated components design using various software packages. Construction of sixteen apartments has been completed using innovative techniques like precast roof and new materials like wood substitutes, clay flyash bricks and red mud cementitious binder. This was done with the assistance of National Building Organisation. The programmes in Metallurgy & Materials

involved integration of existing capabilities and technical linkages in the areas like metal-matrix composites, FRP components, surface engineering, performance improvement of mine and agricultural implements. Specialized technical services for failure investigations of components, structures for thermal power stations attracted considerable attention. Several projects were pursued in the area of improved materials for mining implements/machining, farm implements, surface engineering, innovative coal preparation and beneficiation techniques, flyash utilization in land development for agriculture, environmental studies and water resources management.

A brief account of some of the major projects is presented here:

BUILDING MATERIALS

RRL has consolidated a strong base for development of low-cost/alternative building materials and components, including: red mud/fly ash-based wood substitutes, red mud cementitious binder, fly ash bricks with a variety of soils, materials/components using natural fibres in low-cost housing; construction of demonstration houses with innovative materials and technologies; and carrying out materials evaluation and characterization and component designing.

Major funding for these projects has been obtained from the Ministry of Urban Development, Building Materials Technology Promotion Council, Department of Science & Technology, National Building Or-

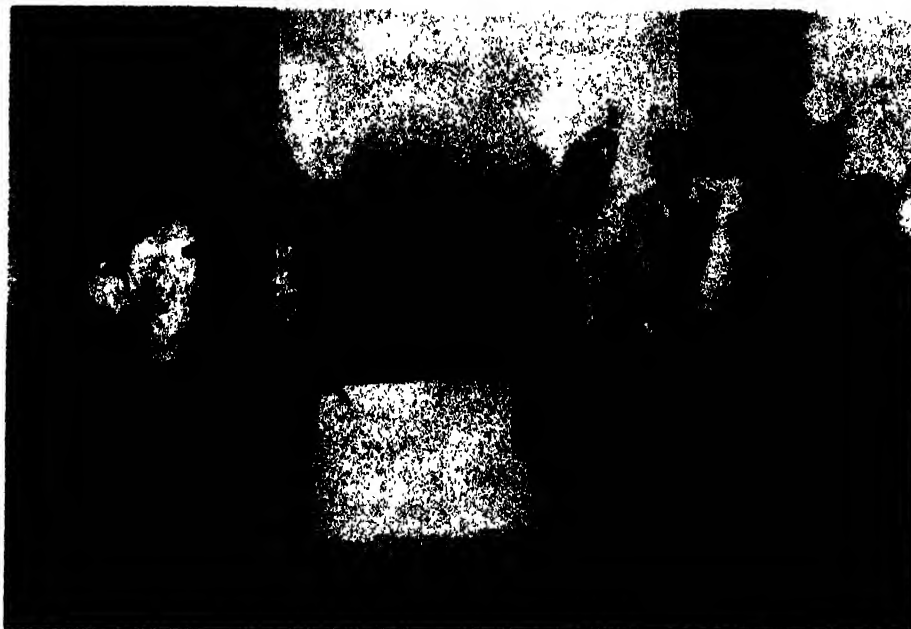
ganisation (NBO). And to enable mass application of products like wood substitutes, clay fly ash bricks, the licensees have been provided a major technical back up to facilitate technology development assistance from financial institutions.

Prototype Houses

Sixteen prototype houses were constructed using new materials and techniques, with funding from NBO and CSIR, with a view to carrying out field trials of the new techniques developed by the laboratory. It has been possible to effect about 15% saving in cost by adopting the new technologies/materials and 12% saving in total cost of construction. A cementitious binder based on red mud waste from aluminium industry has been used in base concrete for foundation and stone masonry. Clay fly ash bricks produced by the RRL have been used in superstructure. Precast RCC slabs developed by CBRI, Roorkee have been used for roofing. R-wood, an eco-friendly and hundred per cent wood substitute developed by the RRL has been used for door shutters. Two blocks, each having eight flats have been built. The total plinth area of each flat is 850 square feet, including common areas.

Building Materials Characterization

The analysis of red mud fibre polymer door shutter and red mud fibre composite corrugated roofing sheet have been done using 'Finite Element Analysis of Structures' (FEAST) and 'Numerically Integrated



Shri K.S. Sharma, Union Secretary, Department of Urban Employment & Poverty Alleviation; Prof. T.C. Rao, Director, RRL-Bhopal, and others during inauguration of the prototype houses built by RRL, Bhopal, using innovative techniques and materials, with NBO support

Structural Analysis' (NISA) software. The design procedure through these packages has led to improvement in the reliability of the components. The optimized design of the structure has led to weight reduction.

METALLURGY AND MATERIALS

The activities in this area are related to: Composite materials including MMCs, ceramic fibre reinforcements, FRP materials; Upgradation of mining and farm implements for improved performance and life; Metallurgical failure investigations, particularly for power plant components, Remnant life assessment (RLA) and Life extension studies; Materials and process development, e.g. trimetallic bearing pads, magnetic materials, grinding media, squeeze casting, variable pressure shot control casting for aluminium alloys, Zn-Al alloys and welding; Surface engineering; and Testing, calibration and materials evaluation.

Failure Investigation and Life Extension Studies

Specialized technical services for failure investigations, remnant life assessment and life extension studies have attracted considerable attention and a major market is emerging in this area.



Investigations on coal feed bunkers of a Thermal Power Plant

RRL was called upon to carry out investigations on various components and structures such as boiler tubes, coal feed bunkers, rotor shafts, ropeway trestles, electrostatic precipitators for various operations of M.P. State Electricity Board. Integrity evaluation of structures for impregnation plants and water treatment plants was undertaken. Work in the area was also carried out for Diamond Cement Ltd, Damoh; National Fertilizers Ltd, Guna; and HEG, Mandideep.

Aluminium Alloy-based Composite

Aluminium alloy-based composite brake drum developed by RRL was evaluated in Nissan Joga Jeep at VRDE, Ahmednagar, and its performance was found to be better than the existing cast iron brake drum with respect to brake efficiency and temperature rise. Recently, aluminium composite brake drums were fitted in a Maruti Van and tested at MUL for 10,000 km. Their performance has been found to be encouraging, indicating the

possibility of using Al-composites in other automobile components like crankshaft, brake shoes, connecting rods, piston, cylinder blocks, etc.

Materials for Mining Industries

Mining industries in India are progressively looking forward to overcome problems associated with shorter life spans of equipment/implements because of higher wear rate. This leads to the consumption of large quantity of materials and energy. Aluminium metal matrix composites and Z-A alloys are light weight and possess improved wear resistance. Under a project on 'Development of cost and energy-effective materials for mining industries', sponsored jointly by Ministry of Mines, DST and CSIR, studies are being made on the following components: Vortex finder, refrax apex insert for cyclones and impeller and inlet for Sala pumps (to be made of Al-alloy composites); Bearings for shovel and other mining machineries (to be made of SLIZ alloy); and Balls for ore grinding.

A project on 'Development of Alternative Materials for Coal-Grinding Components' has been also undertaken.

Trimetallic Bearings

A process for trimetallic components for wear (bearings) applications has been developed. In this, a thermally conducting layer of copper/copper alloy is inserted between a steel substrate and babbit lining to bring about more efficient heat transfer in operation.

MINERALS AND COAL PREPARATION

The RRL extends technical advice and consultancy for introduc-

tion of innovative techniques like Vorsyl separation, air sparged hydrocyclone column flotation. In particular, the laboratory has built up good expertise in the area of beneficiation of non-metallic minerals.

Water-only Cyclone at Jamadoba Coal Washery

The run-of-mine coal when crushed for beneficiation, contains about 20% fines (< 0.5 mm). This fraction is generally treated by froth flotation process. Previous studies carried out at RRL on the efficacy of water-only cyclone for beneficiation of Sijua Group coal fines have shown potential use of this technique. Based on this, TISCO has funded a project for plant trials on 300 mm water-only cyclone. The unit has been fabricated and installed at Jamadoba Coal Washery and trial runs are in progress. The replacement of existing froth flotation process by water-only cyclone is expected to result in large savings in reagents consumption, power and equipment maintenance.

Vorsyl Separator

Studies carried out on 400 mm heavy medium cyclone and 400 mm Vorsyl separator at TISCO's West Bokaro Washery-I have shown superiority of Vorsyl separator over heavy medium cyclone. To confirm the findings, TISCO, Department of Coal and DST have further funded the installation and plant trials on bigger Vorsyl separators, 500 mm and 600 mm units, at West Bokaro Washery-II, Dugda and Sawang Coal Washeries respectively. The tests at West Bokaro Washery-II have confirmed a higher yield of clean coal with desired ash content, compared to the existing heavy medium cyclone in the washery. The installation and trials on this unit at

Dugda (BCCL) and Sawang (CCL) coal washeries are in progress.

Studies on Multi-Gravity Separator at Rajpura Dariba Mines

The Hindustan Zinc Limited is facing a problem of higher graphitic carbon in the lead rougher concentrate. A study was carried out to reduce this impurity using Multi-gravity Separator wherein the graphitic carbon was reduced from 9.8% to less than 2%. Based on this study, HZL has installed an industrial size double drum multi-gravity separator at Rajpura-Dariba Mines. The optimization studies of this unit resulted in reduction of the graphitic carbon from 1.6% to 2%.

Performance Evaluation of Air-Sparged Hydrocyclone to treat Indian Coal Fines

Funded by DST, the project aimed at evaluating the performance of air-sparged hydrocyclone (ASH) as an alternative to conventional froth flotation process. Three different coal samples were tested and results compared with that of conventional and column flotations, and the following observations made: ASH is capable of producing clean coal having yield and ash content similar to that produced through conventional and column flotation. It is necessary to recirculate the underflow of ASH to recover coarser coal particles. ASH requires higher reagents dosage to get yield comparable to that of conventional and column flotation. However, tests carried out elsewhere using plant-scale ASH unit have shown that the reagent dosage gets reduced drastically with larger ASH units. Extremely high levels of collector and frother dosages are detrimental to ASH flotation.

ASH offers considerable savings in floor space, process time and also has no moving parts, hence, less maintenance time.

RESOURCES DEVELOPMENT

Main capabilities in this area exist in Resources Modelling and Systems Analysis, particularly for : Groundwater Resources Management, Groundwater Contamination Studies, Watershed Development and Land & Water Resources Management and Planning.

Water Management and Development of Irrigation Potential for Sericulture

The Directorate of Sericulture, M.P., has sponsored two major projects: (i) Water Management in Selected Sericulture Farms of Madhya Pradesh, and (ii) Development of Irrigation Potential in Raigarh, Bilaspur, and Sarguja Districts of Madhya Pradesh. The first project aims to understand the physical framework and geological set-up and design

the measures for improving irrigation facility in sericulture farms of various districts of M.P. These measures essentially involve enhancement of present water availability through the development of source and construction of cost-effective water and oil conservation structures. The second project aims to understand the physical framework and geological set-up in various sericulture farms for water management for mulberry plantations in three districts of M.P. viz. Bilaspur, Sarguja and Raigarh with the participation of local people, particularly, women.

Rejuvenation of Clogged Hand Pumps

Under the sponsorship of Rajiv Gandhi National Drinking Water Mission, Ministry of Rural Development, Government of India, a process for rejuvenation of clogged hand pumps has been developed wherein the clogged wells are treated with a non-toxic chemical composition

and hydrofractured by water under high pressure. Twelve clogged hand pumps located in different villages near Bhopal city have been successfully cleaned using the chemical-hydrofracturing process.

ECOLOGY/ENVIRONMENT

Flyash Utilization in Land Development

The pilot project on use of flyash for wasteland development at NTPC, Rihand Nagar (U.P.), was successfully completed in 1995. Further experiments have been undertaken to study long-term effect of flyash in respect of soil fertility and food quality. In the rabi season, experiments were carried out in all the plots of Dodhar and Nilgiri, following the previous treatments of pond ash application and also with an additional treatment of T3 (i.e. 5% PA in steps every year). Studies are being carried out to improve the soil fertility by optimizing the concentration of pond ash mixing with soil.

NALCO has sponsored a similar project at Angul and Damanjodi in Orissa. The initial field studies have shown excellent results. To conduct the pilot scale demonstration on utilization of flyash for wasteland development, a 5.0 acres plot has been selected and food crops, vegetables are being grown in controlled as well as in the flyash filled plot in the rabi season.

EIA for LPG Storage Facility

IMS Petrogas Ltd is the first private sector company to set up a LPG storage facility at Port of Portbander. The total capacity of the LPG storage is 1,20,000 MT per annum. Here, LPG is being stored in



Cattle protect trenches to arrest soil erosion at Dabri village, under Rajiv Gandhi Mission for Watershed Development

six 1350MT Horton spheres for onward transmission to LPG bottling plants in different parts of the country.

A study on Environmental Impact Assessment (EIA) has been undertaken in an area of 10 km radius from the project site for assessing the effect on environment components, viz. air, water, land, biological environment and noise and socio-economic impact.

EIA for Captive Power Plant of Ishar Alloys and Steels Ltd, Indore

Shri Ishar Alloy Steel Ltd (SIASL), Indore, which produces a wide range of steel grades, proposes to install a 25 MW diesel generator power plant. RRL has been assigned the task of rapid EIA and comprehensive studies for the power plant using heavy fuel oil.

EIA for Proposed Leather Complex at Adampur

Rajiv Gandhi Gramodyog Mission (RGGM) in collaboration with Leather Technology Mission (LTM) is to set up a Leather Complex at Pipalkhedda in Raichur District of Madhya Pradesh. Rapid EIA incorporating one season's data and comprehensive EIA incorporating three season's data are under progress.

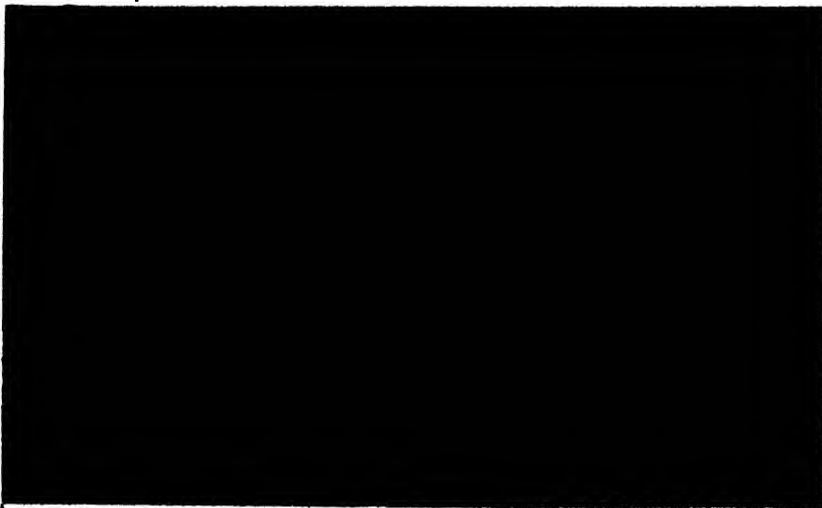
EI & RA of proposed Floating Hotel at Bandra Coast, Mumbai

The project involves study of the environmental status and risk assessment at present and the impacts on it after the speciality restaurant cum hotel is established on board the stranded ship *M.V. Zhen Don* off Carter Road, Bandra Sea Face, Mumbai. One season monitoring for

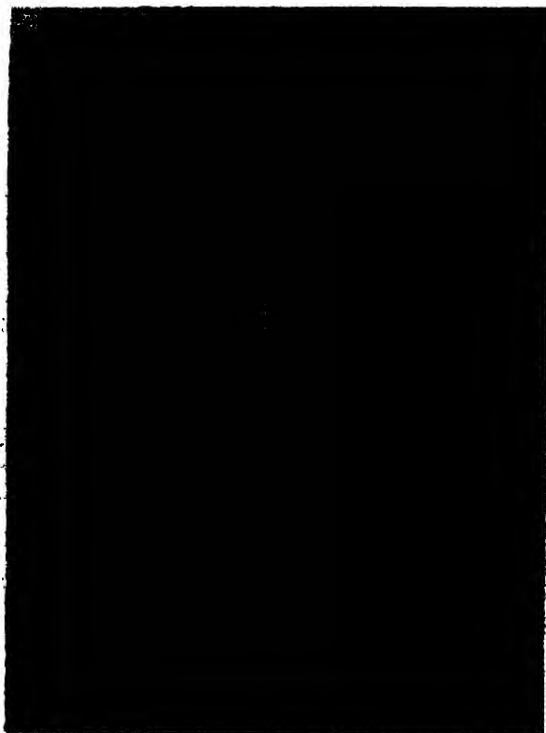
air, soil, water and biological matter has been carried out.

EI & RA for proposed 120 MW Gas Turbine-based Power Plant at Marmugao

Reliance Industries Ltd proposes to set up a 120 MW gas turbine-based power plant using gas/naphtha as the basic fuel for power generation at Marmugao Taluka of Goa. RRL has been given the task for EIA studies for the above project. The main objective of these studies is preparation of rapid EIA report covering one season monitoring and comprehensive EIA report covering three seasons' monitoring for different environmental components, based on Ministry of Environment and Forests guidelines. One season monitoring for air, water, land environment has been completed successfully and studies related to other components of environment



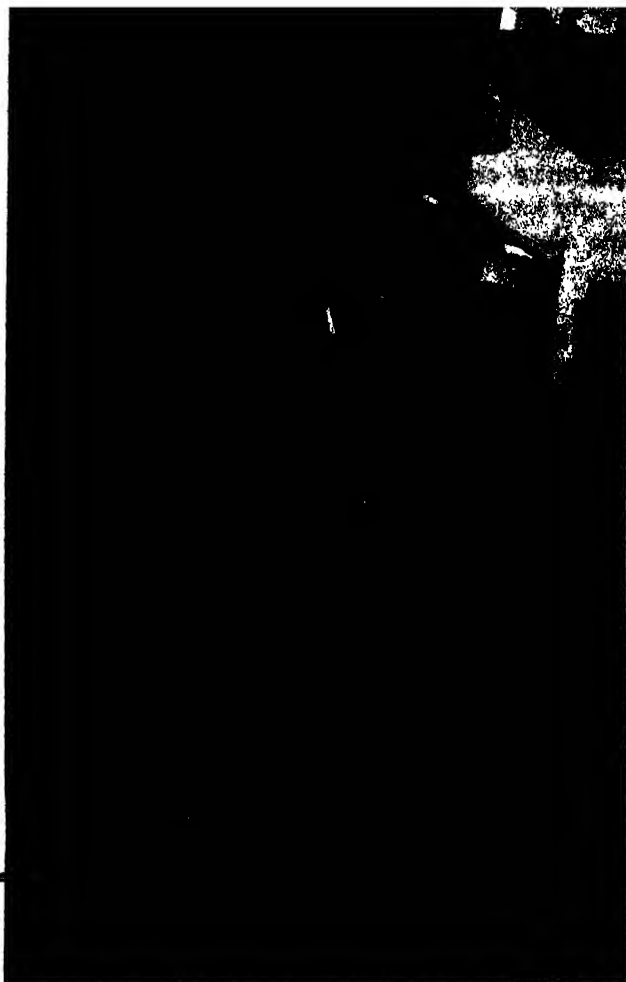
Marine water sampling for *HOATHI*, Mumbai (*left*); and River water sampling of a gas turbine-based power plant at Goa



such as biological, socio-economic is under progress.

EAS for Urea and Ammonia Plant of Rashtriya Chemicals and Fertilizers, Thal

It is one of the major fertilizer producing industry with various unit operations/processing operation during the production. RRL has been given environmental audit of the environmental management programme. Work on preaudit and onsite audit phases has been completed and that on post-audit phase is under progress. □



Stack monitoring at ammonia plant's primary reformer of RCF Thal Complex, Mumbai

Aromatic & Medicinal Plants

RRL-Bhubaneswar's Lab to Land Programme

FORMED in 1969 to carry out work on floristic survey of Orissa and introduce the cultivation of indigenous and exotic plants possessing aromatic and medicinal values, the Aromatic and Medicinal Plants Division of Regional Research Laboratory (RRL), Bhubaneswar, had introduced 30 varieties of these plants in the region by 1991. The activities pertained to identification of suitable crop varieties, improvement of genotypes and standardization of agrotechnology

for commercial cultivation. In 1991, the Division initiated a programme on Lab-to-Land Technology Transfer of Aromatic and Spice Plants for Rural Development by creating awareness on aromatic grasses such as palmarosa, citronella, lemongrass, etc. and spice plants like cinnamon, through training courses, technology meets, workshops, farmers' get-togethers and national environment awareness campaigns. By the middle of 1997, the laboratory had organized 13 training courses,

two farmers' get-togethers (at Phutjar and Vanjanagar), three technology transfer meets (at Visakhapatnam, Calcutta and Guntur), two national workshops (at Guwahati and Bhopal) and two popular talks for farmers (Nimapara) and school students in the block-level exhibition at Baliana. Government officials from State Departments of Agriculture, Horticulture, Forest, Soil Conservation, etc. banking organizations, NGOs and private entrepreneurs participated in these training courses. The training programmes covered the raising of palmarosa nursery, slips preparation of lemongrass and citronella plantation. Harvesting of these aromatic grasses and extraction and separation of essential oils were demonstrated to the trainees.

The aromatic grasses yield a net profit of Rs 10,000 per hectare per year. The trainees also gained expertise in raising cinnamon to process it for obtaining the cinnamon bark. This crop yields an annual return of Rs 12,000 per hectare.

The Lab-to-Land programme has drawn considerable attention of other states like Andhra Pradesh, Bihar, West Bengal, Madhya Pradesh, Maharashtra and Tamil Nadu. Presently, palmarosa in over 1000 hectares and cinnamon in a few hundred hectares are being harvested through RRL consultancy. Over 20 firms from states are involved in this cultivation. In addition, the programme aims at soil conservation and improving the ecosystems, e.g. lemongrass plantation in chromite overburdens.

The programme has helped in the utilization of waste land, generation of waste land and improvement in the socio-economic conditions

Fennel to keep Aphids at Bay

THE scientists of Central Institute of Medicinal and Aromatic Plants (CIMAP), Lucknow, working in the area of pest management through utilization of medicinal and aromatic plants, have recently identified an essential oil-bearing spice plant species commonly known as fennel (*Foeniculum vulgare*) which minimizes the multiplication of mustard aphid (*Lipaphis erysimi*) in the oil seed mustard plants inter-cropped with fennel. It appears that during growth and development of the plant, some of the allelochemicals released by the fennel may deter the egg laying capability of winged female aphids and their further multiplication at parthenogenetic stage.

Mustard or brassica is a major edible oil source in India. For some time, edible oils have been in short supply in India and are imported in considerable amounts. The bottleneck in cultivation of high quality mustard

plant is the attack of a serious pest known as mustard aphid (*Lipaphis erysimi*). This pest extracts large amount of sap from the stem, leaf, flower, unripened seeds of mustard plants, lowering their growth and yield. The aphid is a vector for a number of viral diseases of mustard plant which in turn cause further harm to the plant, thereby causing considerable yield losses. The efforts made so far, to control the aphid have not been eco-friendly as the applications of synthetic pesticides leave the risk of residue problem. The work carried out by the CIMAP scientists is the first of its kind relating to the organic method of mustard aphid management by intercropping a common spice and essential oil-bearing plant. Besides playing a vital role in pest management the fennel could be useful to the farmers in fetching additional return through intercropping with mustard. □

ing the weaker sections (including SC/ST) of the society and pool their land for cultivation; Testing the field soil and water quality and taking remedial measures to recondition the soil as per the need; Cultivating palmarosa and jamrosa grass; Designing, fabricating and installing a suitable capacity distillation unit for processing harvested grasses for extraction of essential oils and arranging for their sale; Designing, fabricating and installing a suitable capacity agro-waste biogas plant for gas generation and suggesting proper utilization methods for the generated gas; Demonstrating the total technology package after its long-term operation through villagers.

Twenty-one acres of waste and marginal land owned by the farmers was made available for the project. The RRL provided all the inputs in terms of material, manpower, necessary hardware and systems required for the successful implementation of the project. A co-operative society, 'Shri Ram Krishna Seva Ashram, Beladal' was constituted and identified as beneficiary for the project.

The soil was found to be deficient in NPK and therefore green manure, daincha plantation, mulching of water hyacinth as green manure and cow dung as farm manure were applied followed by the recommended chemical fertilizer after the plants attained about one foot height. Two open wells were dug for irrigation. The land was made suitable for cultivation by deep ploughing using tractor with disc plough.

Kewda slips were planted all along the boundary of the 21 acre

for the development of tribal and rural people.

Implementation of Technology Package on Aromatic Plants at Beladal Village

The laboratory has developed a complete technology package starting from cultivation of the aromatic grasses to the utilization of the agrowaste. Aromatic grasses like palmarosa, jamrosa, citronella and lemongrass are suitable for profitable cultivation on waste and marginal lands. Essential oils obtained from these grasses are highly profitable products and deoiled grasses

can be used for biogas generation, and digested sludge as agro-manure. The package is designed to help the weaker sections, and at the same time, solving the energy crisis and minimizing environmental pollution.

In April 1995, the laboratory took up a Department of Biotechnology-funded project on 'Bioconversion of Agro-wastes for Energy Generation and By-product Applications', with a view to implementing the technology package.

Shri Ram Krishna Math, Puri (RKMP) joined the RRL in identifying Beladal village for implementing the project which aimed at identify-

plant as live fencing to protect the palmarosa crop. Besides avoiding soil erosion, these plants would further benefit the farmers as additional source of income within 5-6 years. Daincha (*Serbania spaciosae*) grew remarkably well in spite of the scanty rain fall in 1996. Major part of the daincha crop was ploughed back in the field as green manure while the balance was harvested for seeds required in the next season.

More than 20 kg of good quality palmarosa and jamrosa seeds harvested from the crops raised at the RRL were used for raising nursery on a two acre plot. After plantation in August, the first crop of palmarosa crop was harvested in December. The crop-yield was not as expected but the oil-yield was notable with 0.4% oil containing geraniol to the extent of 90%. About 100 kg of daincha seeds and 20 kg of palmarosa seeds were collected for plantation in the next season. Presently, the plants are 1.25 m high having 25-30 tillers each with a panicle length of 23-30 cm.

Advanced measures like mulching hyacinth over the entire field, deep disc ploughing, bund raising and irrigation channels have been taken up to improve the second crop. A 70 feet deep bore well of 4" pipe diameter with a diesel pump has been installed for proper and timely irrigation of the crop. Local labour has been trained and is being employed for field activities. Members of the co-operative society are totally involved in the day to day activities while two researchers from the RRL have been posted to

coordinate and monitor the field work at the site.

At the laboratory, an improved laboratory scale oil distillation system has been set up to study and characterize the essential oil grasses.

Long-term experiments lasting for over one year have been conducted on a 0.5 m³ conventional KVIC model biogas plant for generation of biogas from agro-wastes. The biogas produced from de-oiled palmarosa was found to be 0.387 m³/kg with 55-60% methane. A 200 kg capacity oil distillation unit and a

5 m³ biogas plant with a number of innovations have been designed and their fabrication is in progress. The project is expected to be completed by March 1998 and would be handed over to the beneficiary with assured successful operation of the technology package.

The project is unique as it brings science and technology to the doorsteps of the common man. The progress at the project site is excellent enough to draw a number of commoners to its doorstep and enthrust them for similar treatment of their waste and marginal land. □

New Externally-funded Projects at NML

THE externally-funded projects taken up by the National Metallurgical Laboratory (NML), Jamshedpur, in the past couple of months, include:

Environmental effect on and electrochemical characterization of nano-crystalline ferro-magnetic alloys (Department of Science & Technology);

Skill-cum-technology upgradation programme for Howrah foundry cluster (SIDBI, Calcutta);

Quality Improvement programme for iron powder (M/s Newatia Electro Metal Powders);

Beneficiation of iron ore fines (Jindal Strips);

State-of-the-art report on BF cooling system in relation to different grades of refractories (Tata Steel);

Initial qualification of electrodes for naval applications (Fusion Engineering Products);

Type of approval of Modl 7018 electrodes (Modl Arc Electrodes Co.);

***In situ* metallography and hardness testing at selected points of boiler turbine assembly of Unit 7 (NTPC, Shaktinagar);**

Hot briquetting of iron for production of 100% HBI or 100% DRI (Vikram Ispat);

Development of advanced materials—Nano-crystalline soft magnetic materials (Datar Switchgear); and

Mechanization of Blacksmith's hammer and development of improved fuel-efficient furnace for artisanal blacksmiths (Department of Science & Technology).

In addition, a Rs 23 million project on Magnetherm has been recently cleared by the Department of Mines, Government of India. Also, MoUs have been signed with SIDBI, Lucknow, pertaining to three programmes—Small Industries Management Assistance, Skill-cum-Technology Upgradation and Entrepreneurship Awareness Camp. □

NGRI Foundation Day Lecture

PROF. C.N.R. Rao, Chairman, Scientific Advisory Committee to the Cabinet, Government of India and President, Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore, delivered the 1997 NGRI Foundation Day Lecture on 10 October 1997, on 'Profiles in Research'. Dr Harsh K. Gupta, Director, NGRI, welcomed Prof. Rao.

In this lecture, Prof. Rao pointed out that science would lose its purpose if it is identified only with the short-term gains. Best of science can come out only when it is unfettered and has least government interference. He expressed that science should not be looked upon as any other profession and scientists should not expect rewards or returns from their endeavours because "doing science itself is a reward". In this context, he cited the contributions made by famous sci-

entists like Galileo, Michael Faraday, Newton and others to the society and the hardships they encountered in their endeavours for attaining excellence.

Prof. Rao also stressed the need for more government support for scientific efforts, and added that the country might land "in a delicate situation" if science is ignored. He cited the example of Japan where scientific research is given higher values and status.

After the lecture, Prof. Rao presented mementoes to staff members who had completed 25 years of continuous service at NGRI. Prof. Rao also laid the foundation stone of the proposed VIP Guest House in the NGRI premises. □

CBRI participates in India Build'97

THE Central Building Research Institute (CBRI), Roorkee, participated in the Second International Building & Construction Exhibition 'India Build '97', organized by ITE India Pvt. Ltd, at Pragati Maidan, New Delhi, on 3-5 November 1997, and displayed its achievements in the field of innovative building materials, new construction processes, plants and machinery. The CBRI stall was visited by thousands of people, including manufacturers and entrepreneurs from building material industry, company executives, administrators, political leaders, media personnel, practising architects and engineers, students from engineering and architectural institutions and general public. Shri T.G. Venkaraman, Minister for



Prof. C.N.R. Rao delivering the Foundation Day Lecture (left), and laying the Foundation Stone for VIP guest house at NGRI



Shri T.G. Venkaraman, Minister for Surface Transport, visiting CBRI stall at India Build '97

and transportation, are prone to high risk of explosion owing to the high flammability character of oil. Any source of ignition may cause explosion, leading to not only loss of lives of human beings but also severe damage to the costly equipment and mines. This calls for appropriate accident averting measures, one of which is use of reliable intrinsic and flame proof equipment". This is where the role of the CMRI comes in. The institute is providing meticulous and dependable testing facilities for electrical and electronic equipment in hazardous areas such as oil field, fertilizer industry, etc., he added.

Surface Transport, who inaugurated the exhibition was amongst the distinguished visitors to the CBRI stall. □

connection, he stressed the need for disaster management plan including the awareness programme, particularly for the inhabitants residing around the oil fields.

Shri J. Achari, Scientist-in-charge of Flameproof and Intrinsic Safety Group, CMRI, introduced the course while Shri R.P. Singh, Scientist-in-charge, HRD Cell, proposed a vote of thanks.

This is the second programme sponsored by ONGC for its officials. The valedictory function of the programme was held on 12 December 1997. □

TRAINING PROGRAMMES

Awareness Programme on Mines Acts in Oil Field Operations

THE Human Resource Development (HRD) Group of Central Mining Research Institute (CMRI), Dhanbad, organized a five-day Awareness Programme on 'Mines Acts, Statutory Requirements and Safe Working Practices in Oil Field Operations' commencing from 8 December 1997.

Inaugurating the programme, Shri S.N. Padhi, Deputy DGMS, Dhanbad, who was the Chief Guest on the occasion, explained the scope and functions of DGMS in respect of mines acts, particularly during oil field operations. In this

Earlier, Dr T.N. Singh, Director, CMRI, welcomed the participants to the course. In his speech he pointed out, "Oil field operations, e.g. explorations, drilling, pumping, refining



Participants of the 'Awareness Programme on Mines Acts in Oil Field Operations', with Dr T.N.Singh (fourth from left in the first row). The Chief Guest on the occasion Shri S.N. Padhi is seen on his left

Technology Awareness Programme — Opportunities from CSIR Laboratories for Women Entrepreneurs

THE CSIR-Polytechnology Transfer Centre (PTC), Hyderabad, in association with Kamala Nehru Polytechnic College for Women (KNPW), Hyderabad, organized a two-day Technology Awareness Programme on 'Opportunities from CSIR Laboratories' for Women Entrepreneurs, during 20-21 October 1997 at KNPW, Hyderabad.

The programme was sponsored by the Commissioner of Industries, Government of A.P., and KNPW.

The programme was aimed at filling the technological information gap between the technology generators and users, especially pertaining to CSIR technologies relevant to

Hyderabad District and also to inform the women entrepreneurs/students about the benefits, facilities, expertise and support available for setting up new units in Andhra Pradesh. More than 60 women entrepreneurs/students participated in the programme.

Shri K.V. Shastry, Vice-Principal & Head of the Pharmacy Department, KNPW, was the Chief Guest. Dr P.V. Krishna, Adviser, EDP Cell of KNPW, presided over the function. Shri G.A. Reddy, Project Officer, CSIR-PTC(H) welcomed the participants. Dr N. Giridhar, Scientist, CFTRI Hyderabad Unit, also addressed the gathering.

Inaugurating the programme Shri Shastry stressed the need to ensure the availability of technology to women entrepreneurs and the urgency for developing appropriate technology by utilizing the available resources and skills. He further emphasized that women entrepreneurs should be aware of the technology developments in various CSIR laboratories in the present day context of globalization & liberalization and suggested them to make use of the services of CSIR-PTC, Hyderabad. Shri Shastry also released a publication on project profiles suitable for Hyderabad region.

The following papers were presented in the technical sessions, Food & Agro-based Industries (Dr N. Giridhar, Scientist, CFTRI, Hyderabad); Chemical & Allied Products (Shri G. Sampath Kumar, Scientist, IICT, Hyderabad); Assistance from Andhra Pradesh Industrial & Technical Consultancy Organisation Ltd, Hyderabad (Shri V.N. Murthy, Chief Consultant, APITCO, Hyderabad); New & Alternative Building Materials (Dr P. Shivaji, Scientist, CBRI Unit, Hyderabad); Cultivation & Ex-



Shri K.V. Shastry releasing a publication on CSIR project profiles suitable for Hyderabad region, during the Technology Awareness Programme: Opportunities from CSIR Laboratories for Women Entrepreneurs, and a view of the participants

traction of Medicinal and Aromatic Plants (Dr P.N. Kaul, Scientist, CI-MAP Field Station, Hyderabad); Procedures on Technology Transfer and Assistance from PTC-Hyderabad (Shri G.A. Reddy, Project Officer, CSIR-PTC, Hyderabad).

Glazed/Unglazed Terracotta Products

THE Central Glass & Ceramic Research Institute's Khurja Centre conducted a Training-cum-Demonstration Programme on 'Glazed/Unglazed Terracotta Products' under the All India Co-ordinated Programme on Pottery, from 3 to 17 November 1997. This programme was specially designed for the rural potters in different parts of the country. Co-ordinated by the Centre for Technology and Development (CTD), New Delhi, with financial assistance from the Department of Science & Technology, New Delhi, the programme was attended by 11 artisans from: Centre for Action Research Development (CARD), Nandapur; CSTSD, Rohtak; Madhya Pradesh Vikas Sabha (MPVS), Durg; and FOSET, Calcutta.

Inaugurating the programme, Shri Rajan Sharma, CTD, New Delhi, spoke about the scope of glazed terracotta ware in India and

There was an intensive interaction between the scientists and the participants. Several entrepreneurs have shown keen interest in CSIR technologies. □

abroad. He also mentioned about different schemes of financial assistance to rural artisans for setting up their field units.

The programme comprised theoretical lectures and practical demonstration, covering the following aspects: recent advancements in terracotta ware, basic raw materials and their characteristics, development of body mixes and their suitable glazes, different fabrication techniques, improved kiln design and firing of terracotta ware, testing and quality control, defects in terracotta ware and their remedy.

The programme was first of its kind organized by this Centre where the technical skill for fabrication of decorative items was demonstrated by master craftsmen, through their direct participation and quality upgradation of terracotta ware was discussed utilizing improved body mixes, suitable glazes & firing tech-

niques and improved energy-efficient kiln of this institute. The practical demonstration for firing of terracotta ware was carried out in a 2m³ oil fired shuttle kiln.

At the valedictory function, Shri A.K. Gupta, Dy. Scientist-in-Charge of the Khurja Centre, welcomed the Chief Guest Dr M.A. Lari Azad, Asstt. Professor, Department of P.G. Studies and Research in History, NREC College, Khurja. Speaking on the occasion, Dr Lari talked about the history of terracotta ware in India, particularly in Khurja. He also gave away certificates and the products made by the participants during the Training Programme to them. □

Repair & Preventive Maintenance of Basic Health Equipment

THE Service and Maintenance Division of Central Scientific Instruments Organisation, Chandigarh, conducted a training programme on Repair and Preventive Maintenance of Basic Health Equipment, from 3 to 8 November 1997. In this programme, organized in collaboration with UNICEF, about 20 technicians attached to district-level hospitals at Madhya Pradesh participated. It included the-



Valedictory function of training-cum-demonstration programme 'Glazed/unglazed terracotta products', in progress, and the trainees showing the products made by them during the programme



and solve the problems related to repair and maintenance of health equipment. This aspect, he said, has not been taken care of by the manu-

sized the need for having instrument repair section in the hospitals and also suggested that CSIO must be involved while forming the specifi-



Dr Mohindra P. Minocha, Chief Medical Officer and Head, Pediatrics, General Hospital, Chandigarh, delivering his address during the valedictory session of 'Repair & Preventive Maintenance of Basic Health Equipment'; and a view of the audience

ory as well as practical sessions on basic health equipment like microscopes, autoclaves, neo-natal resuscitation kit, blood pressure instruments, centrifuge machines, suction machines and weighing machines.

Dr B.D. Gupta, former Professor and Head of the Department of Radiotherapy, PGI, Chandigarh and presently Director Principal, Punjab Institute of Medical Sciences, Jalandhar, inaugurated the programme and delivered the keynote address. He appealed to the participants to initiate a dialogue with the faculty so as to get the thorough information about the instruments.

Representatives of the UNICEF Shri G.R. Baru, Shri Bhuyan and M.P. State Cold Chain Officer Shri V.K. Srivastava were also present at the inaugural session. Prof. S. Mohan, Director, CSIO, delivered the presidential address.

In his address, Shri Baru called upon the participants to contribute,

facturers, who think that their responsibility is limited to the sale of the equipment. There is a dire need to create awareness on this aspect, he added.

Earlier, Smt. Mohana Ramamurthy, Scientist-in-Charge, Service and Maintenance Division, CSIO and Co-ordinator of this programme, welcomed the participants and guests.

Participants were also taken on a visit to various industries at Ambala. It helped them widen their knowledge and the intricacies involved in fabrication of lenses for the microscopes. The hands-on-session evoked a lot of interest among the participants to not only handle these instruments but also repair these and have the preventive maintenance done.

In the valedictory session, Dr Mohindra P. Minocha, Chief Medical Officer and Head, Pediatrics, General Hospital, was the Chief Guest. In his address, he empha-

cations and purchasing of the medical equipment.

Dr S. Mohan, in his presidential address, agreed to the suggestion that such training programmes be held for a longer duration in future. □

Training programme on 'Cost-effective Building Materials and Technologies' for Women

THE Central Building Research Institute (CBRI), Roorkee, organized a Mason Training Programme, exclusively for women, on 'Cost-effective Building Materials and Technologies' from 30 August to 4 September 1997, at Bilaspur. The programme was organized in association with Entrepreneurship Development Cell (Bilaspur) of M.P. Council of Science & Technology and was sponsored by MPCST, Bhopal. It was specially designed and conceived with the belief that given

the opportunity to learn the construction skill during their employment, women workers will be equally adoptive and responsive to learn the mason's skill and trade. And the learning of skill will help improve their earnings and living status.

Twenty-one women construction workers belonging to SC/ST and weaker sections were imparted training in mason's trade, casting of precast products and improved rural houses.

Special interaction was arranged between trainees and representatives of local engineering/construction departments. A press meet was also organized to create awareness in the area on a wider scale. All the local and regional newspapers have given wide publicity of the programme. On the concluding day a mason's tool-kit and a certificate was given to each of the trainees. □

Advanced Training Programme on Intellectual Property Rights

THE Intellectual Property Management Division (IPMD) of CSIR, in association with the Central Glass & Ceramic Research Institute (CGCRI), Calcutta, organized a three-day training programme on Intellectual Property Rights at CGCRI, during 7-9 August 1997. Held under a World Bank Project, the programme aimed at training the personnel from CSIR laboratories in the Eastern Zone, for enhancing value and volume of Intellectual Property in CSIR to meet the targets set in *CSIR Vision 2001*. About 50 personnel participated in the programme.

The faculty for the programme, Mr John Gould, Mr Michael Schuman and Mr Brent Routman from Merchant & Gould, leading Patent attorneys in USA, provided an illuminating excursion of the US patents laws and legislature.

The programme comprised three technical sessions. The first session covered four topics: intellectual property overview, overview of patent process, patentability, and the patent application on a global basis, including India. In the second session, a good number of practice-oriented drafting specifications and claims were demonstrated and discussed. The searching of patents was also discussed. It was advised to make a patents search before starting to invent, through computerized databases available in CD-ROM. The third technical session dealt with laws and legislation governing patents filed in India and other countries specially USA. The topics discussed were — international protection issues, patent infringement and enforcement, licensing of patent rights.

Shri N.R. Subbaram, Business Consultant, CSIR, in his welcome address explained how patenting policy can stimulate higher creative activities which in turn will facilitate economic growth and industrial development. Earlier Dr C. Ganguly, Director, CGCRI, while inaugurating the programme, explained the importance of understanding the critical role of IPR. Dr M. Chakravarty, Scientist, CGCRI, proposed a vote of thanks. □

NEW PUBLICATIONS

CSIR — Looking Back

THE CSIR Pensioners Welfare Association has brought out a book entitled *CSIR—Looking Back*. A collection of reflective articles contributed by 12 retired scientists and science administrators who have been closely associated with CSIR during much of their active careers, this publication admirably brings out the vision, foresight and genius of the pioneers who helped establish the CSIR. It reminds us of the effort and dedication that has gone into the making of such a fine and unique R&D organization that CSIR has developed into today and provides a glimpse into the culture, heritage and work ethos in CSIR.

The book was released by Dr R.A. Mashelkar, Director General, CSIR, at a function held at the Central Drug Research Institute (CDRI), Lucknow. Speaking on this occasion, he said that at a time when the CSIR has brought out a white paper entitled *CSIR 2001 : Vision and Strategy* — as it enters the twenty first Century — *CSIR—Looking Back* is a timely reminder of how, starting from a very modest beginning, CSIR has today emerged as the leading R&D organization in the post-Independent India. He congratulated the CSIR Pensioners Welfare Association for bringing out such a timely publication in the Golden Jubilee Year of India's Independence, and praised the Association for focussing attention on some of the burning problems of the CSIR pensioners and its achievements in looking after their welfare within a short period of five years. He assured that CSIR will always take due care to look after its senior colleagues. He also mentioned about the adequate support from the government and

and A.S.N. Murthy of National Geophysical Research Institute, Hyderabad, has been awarded the M.K. Ray Memorial Medal 1997 by the Geological, Mining and Metallurgical Society of India, Calcutta. □

Dr J.S. Yadav

DR J.S. Yadav, Scientist, Indian Institute of Chemical Technology (IICT), Hyderabad, has been elected a Fellow of the Indian National Science Academy (INSA), New Delhi. Dr Yadav has been conferred with this honour



for achieving high level of excellence in the field of organic synthesis. His contributions in pheromone research (integrated pest management) and drug development are noteworthy. He is recipient of many prestigious awards including the Shanti Swarup Bhatnagar Prize in Chemical Sciences for 1991. □

Dr R.A. Mashelkar releasing the publication *CSIR -- Looking Back*

the PM, to strengthen and modernize the CSIR where all brilliant young scientists shall be provided opportunities to contribute to national development.

Dr T.N. Khoshoo, former Secretary, Department of Environment, talked about his association with National Botanical Research Institute (NBRI) and highlighted the contribution of NBRI and praised CSIR for its unique culture of flexibility and innovation in R&D as well as administration. He also highlighted the emerging challenges that the country faces in the field of environment and energy conservation. Dr Nitya Anand, former Director of CDRI and a famous medicinal chemist talked about the human resource development in CSIR and asked for an effective policy to ensure adequate opportunities to young brilliant scientists so that brain drain can be stopped. The present Director of CDRI, Dr C.M. Gupta described his deep association with CDRI and the upcoming Institute of Microbial Technology at Chandigarh, to highlight the strength of CSIR culture. Dr S.P. Popli, retired Deputy Director,

CDRI, narrated his experiences of the early days of the CSIR.

Earlier, Secretary of the CSIR Pensioners Association, Dr R.P. Rastogi, an eminent plant chemist, gave a brief history of the Association and its achievements in securing several facilities for the CSIR pensioners, particularly in getting extended medical facilities for them at par with CGHS and also talked about the genesis of the book released. Dr V.C. Vora, President of the Association, presided over the function and introduced the Chief Guest, Dr Mashelkar. Dr G.B. Singh proposed a vote of thanks to the large gathering of eminent scientists and science administrators of the city. □

HONOURS & AWARDS

NGRI paper wins M.K. Ray Memorial Medal

THE paper entitled 'The seismic velocity structure in the western part of the Bengal basin: some significant results', published in *Indian Journal of Geology* by Dr P.R. Reddy, N. Venkateswarlu, P. Koteswara Rao, A.S.S.S.R.S. Prasad

Shri Sohan Singh Seehra

SHRI Sohan Singh Seehra, Dy. Director & Head, Rigid Pavement Division of Central Road Research Institute, New Delhi, has been awarded Doctorate Degree in Civil Engineering by the University of Roorkee, for his 'Investigations on Rollcrete Pavement Layers'. The degree was conferred on him on 26 November 1997 at the Annual Convocation of the university. □

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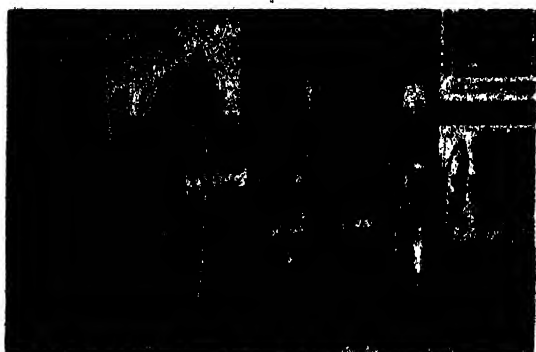
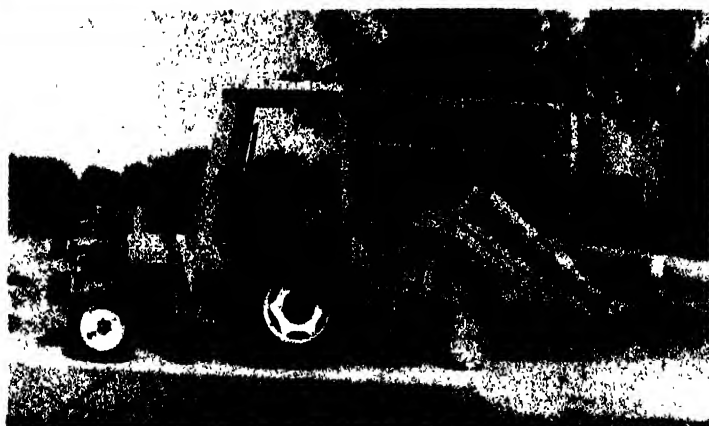
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CSIR NEWS



R & D products of Central Mechanical Engineering Research Institute, Durgapur (clockwise from top left): Sugarcane harvester (developed in collaboration with VSI, Pune), Modern oil expeller, Light-weight power tiller, Remotely operated mobile manipulator for mopping operation of heavy water for NPC, and Remotely operated vehicle for inspection of underwater structures such as off-shore drilling rigs, marine pipelines, etc. A report on R & D accomplishments of the Institute appears on p. 37

CMRI Technology helps save Rs 400 million at Khottadih colliery

SUCCESSFUL control of fire in a longwall panel of Khottadih colliery of ECL with the help of CMRI (Central Mining Research Institute, Dhanbad)-developed dynamic balancing of pressure technique and application of cryogenic technology in tandem paved the way for safe recovery of a number of powered supports and other equipment worth more than Rs 400 million.

Owing to sudden loading, a part of the roof of P-3 panel in Samla seam (R IV) at the colliery had collapsed causing extensive damage to most of the powered supports in the face. Fifty-five out of 83 chock shields were badly affected.

The problem was further compounded by the on set of spontaneous heating and the situation forced the mine management to seal the panel by two isolation stoppings—one at the main gate and other at the tail gate of the panel.

It became a matter of great concern since keeping the panel closed for a long time could have considerably deteriorated the trapped healthy supports and render them in-effective. Moreover, increase of temperature above 50°C would have caused heavy leakage of hydraulic fluid owing to failure of 'O' rings, resulting in closing of the supports and consequently, further collapse of the roof. It would have made not only the future recovery operation an almost impossible proposition entailing a loss of entire face supports, shearer and other equipment but also a shattering effect on the morale of the industry.

Thus the control of the fire was to be carried out as quickly as possible, preferably within three weeks and the temperature was to be kept below 50°C.

As an immediate step, CMRI conducted extensive thermo-compositional survey of the sealed area and ascertained the status of fire. The situation dictated fusing of liquid nitrogen (LN_2) through a borehole (No.7). But the operation was getting interrupted due to blockage of the borehole. To overcome this problem, two more boreholes (No.6 & 6A) were drilled, which, however, did not reach the goaf because of the broken strata caused by the roof fall. Great care was then taken in drilling another borehole (No.6B) which was provided with casing throughout its length. To avoid damage of the casing due to low temperature and freezing of water at the bottom of the borehole, provision was made for evaporation of the liquid nitrogen into gaseous form and

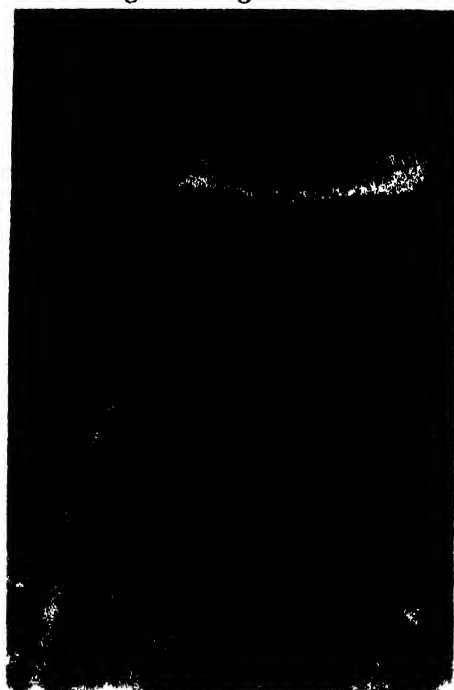
then passing it through the borehole. For this, four evaporators having capacity of about 400 l/h were deployed. In the mean time, a PSA type nitrogen gas generator of capacity 500m³/h, which was lying idle close to the colliery pit, was revamped and pressed into service.

Infusion of nitrogen at the rate of 800m³/h jointly from PSA plant and LN_2 tanker could not produce the expected results. It was realized that the amount was falling short of the requirement. Close examination of the stoppings of P-3, P-2 and P-1 longwall panels revealed that pressure differences across most of them were high, indicating a heavy leakage of air. It was also observed that all the boreholes were at high negative pressure. This called for a careful pressure balancing of all the panels.

Immediately, a programme for careful measurement of pressure at the stoppings was undertaken and detailed strategy for neutralization of pressure differential across the stoppings using the concept of dynamic balancing of pressure was worked out.

With the implementation of pressure balancing technique and infusion of nitrogen from both the sources, the condition started improving and the fire gradually came under control making possible the reopening of the sealed panel within a record time of 19 days. This led to the safe recovery of all the healthy supports and other equipment from the panel.

The entire effort turned into a success story due to judicious application of CMRI technologies as well as sincere and hard work done by the team comprising the officials of mine management, DGMS, CMPDIL, CdFI (France) and CMRI scientists. □



Nitrogen gas being infused through borehole in a collapsed seam of the Khottadih colliery of ECL. The implementation of CMRI's pressure balancing technique and infusion of nitrogen has resulted in controlling the fire and reopening of the sealed panel, and led to a saving of around Rs 400 million

Fixed Film Anaerobic Plant for Wastewater Treatment inaugurated at RRL-Bhubaneswar

STUDIES on Fixed Film Anaerobic Plants for wastewater treatment has made significant progress in the recent years, leading to several new reactor configurations and operational modes for more efficient and stable performance. Compared to conventional anaerobic treatment where the MCRT is rarely greater than twice the HRT, the fixed film process can achieve MCRTs of the order of 10 to 100 times the HRT. Biomass retention time in the form of films allows lower HRT without the chances of cell wash out. In addition, the high efficiency can be maintained over a wide range of organic loading. The system is relatively stable and recovers from shock loads within a few days.

A 0.4 MLD demonstration wastewater (Sewage) treatment plant has been installed at the Regional Research Laboratory (RRL) Bhubaneswar, at a cost of Rs 2.144 million. The Ministry of Non-con-

ventional Energy Sources (MNES) under UNDP/GEF programme provided 50% of the total cost, the Department of Housing and Urban Development, State of Orissa, gave a token grant of Rs 340,000 and CSIR, the rest of the amount. The plant has been set up with the indigenous anaerobic fixed film technology developed by the National Environmental Engineering Research Institute (NEERI), Nagpur.

The RRL Campus which is spread over 150 acres, has about 400 houses with 3000 inhabitants. Although, a conventional sewage disposal system did exist in the campus, the installation of the present plant would bring about proper wastewater management, resulting in energy recovery in the form of biogas, the use of treated effluents for farming and a clean & safe environment in and around the campus. The importance of such treatment plants can be judged from the fact

that India is facing the energy crisis on one hand and wastewater treatment and its meaningful disposal problem, on the other.

The plant basically consists of a sump, a pump house, a grit chamber, two holding tanks and two fixed film high rate biomethanation mild steel reactors and a biogas holder. The sewage is first collected in the wet well through a coarse screen to entrap and remove the large-size particles and other non-degradable matter. It is then pumped to the elevated grit chamber provided with a medium screen to remove inorganic particulate matter and large-size particles not entrapped in the coarse screen collected in the two holding tanks connected in parallel. The sewage from the holding tanks is finally fed to the two mild steel fixed film reactors, each with a capacity of 120 m³.

The fixed film reactors have initially been packed with 38.1 mm dia and 38.1 mm long plastic corrugated pall rings. The bacteria grow and stay over the surface of PVC rings and by this the cell wash out is almost avoided. The sewage in the reactors is biodegraded through microbial action of bacteria, which produces biogas.

The biogas is collected in a 10 m³ biogas holder. At the full designed capacity of the plant 20 m³ of biogas with 75-80% methane is generated daily, which is being presently used for lighting the 'energy park' (plant premises) and the treated effluent from the plant, which is safe for discharge since its



A view of the 0.4 MLD wastewater treatment plant at RRL, Bhubaneswar

Salient Features of the Wastewater Treatment Plant

Capacity of the treatment plant	0.4 MLD
pH of the influent	6.8-7.1
pH of the effluent	7.2-7.6
COD of the influent	180-250 ppm
COD of the effluent	30-50 ppm
Capacity of the storage wetwell	33 m ³
Capacity of the each holding tank (2 nos.)	24 m ³
Capacity of fixed film reactor (2 nos.)	120 m ³
Capacity of the biogas holder	10 m ³
Total biogas produced per day	20 m ³ with 70-75% methane
Type & ratings of the pumps (4 nos.)	Centrifugal non-clog, 3.75 kW
Type of the packing media	Corrugated plastic rings
Area of the land covered by the plant	400 sqm

pollutant level is within the limits prescribed by State Pollution Control Board, is used for plantation.

Inauguration of the Plant

The above plant was inaugurated by Capt. Jai Narain Prasad Nishad, Union Minister of State for Non-conventional Energy Sources, Government of India, on 21 October 1997. Shri U.N. Panjiar, Joint Secretary; Shri A.K. Dhussa, Direc-

tor and Shri A.K. Tripathi, Principal Scientific Officer from the Ministry of Non-conventional Energy Sources (MNES), Government of India, Shri Pradip Monga, GEF Co-ordinator from UNDP, New Delhi; and Dr B.K. Handa, Scientist, NEERI were also present. Shri P.K. Hota, Commissioner-cum-Secretary, Government of Orissa, presided over the function. Prof. H.S. Ray, Director, RRL-Bhubaneswar, welcomed the guests and Dr R.S. Rohella, Deputy

Director, RRL-Bhubaneswar, proposed a vote of thanks.

The plant is expected to be fully operational shortly. MNES has agreed to provide more assistance for utilization of the excess biogas for heating purpose in a nearby canteen and lighting of a road through biogas lamps.

Workshop

A National Workshop on Sewage Treatment by Biomethanation was also organized on the same day. More than 50 scientists, engineers, technologists and many State Government officials working in the field of sewage treatment and Non-conventional and Renewable Energy Resources attended the workshop. A number of research papers in the field of high-rate biomethanation and renewable energy were presented during the workshop. □

New Contract Projects at CSMCRI

THE new contract projects taken up/being negotiated by the Central Salt & Marine Chemicals Research Institute (CSMCRI), Bhavnagar, in the recent past, include: Environmental Impact Assessment Studies on the effect of soda ash industry effluent (M/s Birla VXL Ltd, Porbander); Designing the salt refinery to produce free flow iodized salt (M/s Salie're de L'Ouest, Mauritius); and Recovery of Citric acid from effluent (M/s Citurgia Biochemicals Ltd, Surat). A proposal on 'Development of absorbents for separation of oxygen, nitrogen and argon from air' has been submitted to DST, New Delhi. □



Capt. J.N.P. Nishad inaugurating the wastewater treatment plant at RRL-Bhubaneswar. Seated on the dais (from left) are: Dr B.K. Handa, Shri P. Monga, Shri U.N. Panjiar, Shri P.K. Hota, Prof. H.S. Ray, Dr R.S. Rohella and Dr J.S. Murty

CENTRAL MECHANICAL ENGINEERING RESEARCH INSTITUTE, DURGAPUR R&D Highlights

ESTABLISHED in 1958, the Central Mechanical Engineering Research Institute (CMERI), Durgapur, is a premier R&D institute in mechanical and allied engineering fields in the country. The market-success of the large number of products based on its technology, such as tractors, post-harvest machinery, high-speed machinery for apparel industry, etc. is a testimony of the institute's capability. The newer areas of technology development relate to deep sea bed mining, robotics, CAD-CAM, etc. Services to the industry are being provided in testing, evaluation and calibration for quality assurance. The regional centres of the institute (MERADOs) located at Ludhiana, Pune, Chennai and Cochin extend the reach of CMERI throughout the country. A Liaison Office of the institute is functioning at Calcutta.

During the last three decades, the institute and its MERADOs have developed as many as 150 products and processes. More than 110 licences have taken know-how for various products/processes developed by CMERI for commercial exploitation, and 184 patents have been filed. In recognition of its pioneering role, the institute has been awarded 26 prestigious national awards for product and process development.

Some of the products developed by the institute are: *Agriculture Machines* — Swaraj and Pratap tractors, Modern oil expeller, Sugarcane harvester, Rough terrain fork lift, Sunflower decorticator, Power tiller, Rotillor, Oil seeds cooker/conditioner, Combine harvester, Paddy

transplanter, Rice polisher, Paddy husk combustor, Pedal pump, Sprayers (power driven and knapsack type), Screw press for palm oil, and Potato/groundnut digger. *Machines for Industry* — High-speed industrial sewing machines for garment and hosiery industry, Industrial leather stitching machines (flat bed, post bed and cylinder bed), Automatic straight blade electric cloth cutting machine, Wool knitting machine, Leather shaving machine, Coil expanding machines and spreading machine, High-speed twisting machine, Belt weighing machine, Automatic turret lathe, Bunching machine, Stranding machine, Paper insulating machine, High-speed paper lapping machine, Button hole attachment for domestic sewing machine. *Machines for Miscellaneous Purposes* — Automatic bottle washing machine, Cold forging press (bottom driven, knuckle joint, 300T), Friction welding machine, Centrifugal barrel mass finishing machine for delicate and intricate components, Automatic latch and pin assembly machine for latch knitting needles, Submerged arc welding machine, TIG cutting torch, ZTA cutting inserts, Electrochemical marking machine, Pencil type coating thickness gauge, Probe for ultrasonic flaw detector, Economic steel structures, Paper shredding machine, Radial drilling machine, Automatic reaming machine, Electrodynamic balancing machine, Magnetic particle clutch, Mechanical flow meters. *Products for the Rural Areas/Weaker Sections* — Sabai grass yarn spinning machine, Upgraded fishing hook and brass/bell

metal technology, Mechanized lime kiln, De-airing pug mill, Defibring device for retted husks, Coir treadle ratt, Namda making machine, Semi-automatic power loom, Tillage implements, Reaper binder, Screw press for palm oil, Rice polisher, Deep/shallow well hand pumps. *Products in High-tech Areas* — Remotely operated underwater collecting unit with lifting system, Automated guided vehicles, Robots of SCARA configuration, Inspection and expert systems for fault diagnosis, Image processing for quality assurance, Remotely operated animated crocodile.

In view of the existing market demand and potential for growth, and also the necessity of developing innovation-based patentable technologies for best-in-class new products, the institute will be reorienting its future R&D programmes around the following major areas: Rapid prototyping such as stereolithography; High-speed spindles for turbo-expanders, textile industry, machine tools, etc; Rheocasting and squeeze forming process; and Plant for high reliability components for automobiles.

A vigorous drive is underway for updating R&D infrastructure in various target areas. The manufacturing and CAD facilities have been upgraded at a cost of about Rs 30 million and equipment worth Rs 25 million is in the pipeline. This would significantly enhance the infrastructure available for conducting R&D for the development of new technologies which are cost-effective, competitive and delivered within in-

ternationally accepted time schedules.

An indication of the utilization of the institute's expertise and R&D output is the steep rise in its Lab Reserve fund — from 34.2% of the total ECF in 1994-95 to 50.1% (Rs 52.31 million) of the ECF in 1995-96. Some of the major achievements during 1995-96 are:

Modern Oil Expeller of 10 tonnes/day Capacity—The machine is ideally suited for the efficient extraction of oil from mustard, groundnut, cotton and other oilseeds. It has been developed by the Ludhiana unit of CMERI. It has differentiating features such as a three-stage continuous cooker, a variable speed quill worm gear box, hard-faced worms, high-strength cage bars for greater wear resistance and a water-cooled chamber for efficient temperature control.

It can extract oil in a single-pass crushing leaving only 7% residual oil in the cake. The conventional oil expellers leave residual oil to the extent of 8% even after three or four successive crushings of the seed. The yield from modern oil expeller is better in terms of quality of both oil and oil cake.

Know-how for the expeller has been released to HMT, Pinjore, and three other firms based in Ludhiana, Vadodara and Hyderabad. CMERI has completed the design of a 50 tonnes/day oil expeller also and is now concentrating on the design development of a 1 tonne/day expeller so that expellers of any desired capacity can be developed and with any combination for different segments of the market. CMERI is also working on the development of an acceptable replacement of the traditional 'ghani' whereby the efficiency of extraction can be in-

creased, retaining the quality features of oil in terms of pungency compatible to popular tastes.

Sugarcane Harvester—It has been developed in collaboration with the Vasant Dada Patil Sugar Institute (VSI), Pune. This harvester, comprising cutting, detopping and partial detrashing units, provides an efficient alternative to conventional means of harvesting. The machine has arrangements for laying the crop in rows.

A standard HMT 5911 tractor has been used as a prime mover for this machine. In order to increase the availability of power, an auxiliary engine of 8.9 hp has been mounted on the main chassis to power hydraulic pumps for driving the three hydraulic motors of the harvester, i.e. the divider motor, cane pusher motor and detopper motor.

One important advantage of the MERADO-VSI developed sugarcane harvester is the possibility of its use as a prime mover for other mechanized farm appliances. The cane cutter, the divider assemblies and the detopper units can be removed very quickly for mounting other implements and attachments. Since the three-point linkage is in the front of the driver, it is more convenient and suitable for some tractor operations, such as fertilizer spreading, which are normally done with the implement trailing the tractor. Other applications might include mechanical cane planting and fork lifting of pallets of fertilizer, cane plants, trash blades, etc.

Other advantages of the harvester are: Removal of drudgery involved in cutting and detrashing through replacement of manual labour by mechanical means; Three-fold increase in harvest area as com-

pared to manual harvesting; Substantial reduction in harvesting costs; Higher recovery of crop; Obviation of stubble shaving costs; and Ensuring better ratoon crop through ground cut.

Preliminary field trials have shown that the harvesting capacity (0.5 ha/h) and operating cost (Rs 18/tonne of sugarcane harvested) can be achieved.

Twin Roll Decorticator for Sunflower Seeds—Developed at the behest of the Technology Mission on Oilseeds & Pulses (TMO&P), Government of India, a twin roll decorticator has been developed by MERADO, Pune, for decortication of sunflower seeds. This machine has a reasonable high capacity of decorticating 6000 kg/h of seed. The kernels thus extracted can be used as a protein-rich snack as well as a source of fat-free oil while the hulls serve as a good source for substitute fuel. This twin roll decorticator affords an improvement over the conventional centrifugal dehusker which is considered viable for plants having a capacity up to 2 tonnes/h.

The twin roll decorticator comprises a hopper unit, a feeder unit and a seed guide. The seeds fed to the machine for decortication are made to pass through a pair of rollers running in opposite directions and at different speeds through different motors. The unit has provision for separation of seeds from other impurities before feeding of the batch to the hopper. A seed grader has been further incorporated for improving upon the quality of final products.

The incorporated techno-economic features are: High-capacity decortication; Low-power consumption; Processing different va-

ries of seeds by changing the operating variables; and Low processing cost of seeds in comparison to other conventional equipment.

Advantages of decortication of sunflower seeds prior to crushing are: Reduced extraction and processing costs; Improved quality of oil and protein-rich cake; Enhanced life of expeller components; and Avoidance of the need for dewaxing.

Personal Air Conditioner—This airconditioner is aimed at catering to the cooling of requisite space for use by a single person. Its use will cut down the consumption of power drastically, owing to reduced total load required to cool only a small enclosed environment in the immediate vicinity of the user.

The developed prototype is a compact, self-contained, consumer durable product whose installation requires neither special attachments nor installation expertise. The condensing unit is mounted on a cabinet type enclosure built on a chassis. The cooling unit, connected to the condensing unit by flexible hoses, is mounted on a telescopic stand extending from the chassis. The unit employs special blowers, aerodynamically designed for eliminating thermal shocks, and a cooling coil which affords a low-temperature difference with moderate air flow. The condensing unit is static and eliminates noise from fans. The compressor capacity is of the order of 0.17 hp. Negotiations are being carried out with some manufacturers for the development of its complete technology package.

Intelligent Controller—Based on the MCS-51 type embedded microcontroller, an intelligent controller developed by CMERI has been incorporated in a vending machine for the dispensing of hot beverages

such as tea, coffee, soups, etc. A built-in software designated as per the specifications of the customer performs the different logical operations on demand. The intelligent controller, comprising a single-chip microcontroller with AD controller and other chips mounted on a single PCB, reads various input/output analog and digital signals through the different I/O ports to achieve the desired performance.

The controller can also be tailored to serve as an intelligent front-end I/O module in a distributed process environment whereby individual intelligent modules can independently act to control the various process parameters. The distributed I/Os can finally be hooked to a personal computer so as to constitute an integrated data acquisition and control system. The controller is based on INTEL 8751 microcontroller with 4 kB ROM and 128 kB RAM on-chip.

Harmonic Drive—The drive is an ideal speed transmission mechanism which overcomes major drawbacks associated with conventional gear transmission mechanisms. Harmonic drive gearing is becoming popular the world over for a wide range of precision control applications. Its high torque capacity, low or zero backlash, high single-stage reduction ratios and in-line configuration make it the logical choice in applications such as machine tool drive mechanisms, valve actuators, servo actuator transmission for robots, positioning drives for medical X-ray and diagnostic equipment, antenna positioners, phototypesetters, computer peripherals, etc.

Harmonic drives are presently imported. Their development has been undertaken by CMERI to establish indigenous technology for de-

sign/manufacturing of this highly specialized equipment for a wide range of industrial applications in our country. As a result of this effort, a harmonic drive of following specifications has been developed: 78:1 reduction ratio; 1450 rpm input speed; 0.25 kW input power; 110 Nm output torque; ± 1.5 min of indexing accuracy.

The manufactured unit has been subjected to a series of tests to evaluate the functional parameters, namely reduction ratio, torque capacity, efficiency, vibration and noise and thermal aspects.

The institute can provide know-how for manufacturing harmonic drives having following range of specifications: 50:1 ratio; 1150-3500 rpm input speed; 0.10 to 5.00 kW power. The know-how package consists of: Design procedure for developing harmonic drives for different torque and reduction ratios; Assembly, sub-assembly and detailed component drawings as well as specifications for bought-out components; Component manufacturing technology and assembly techniques; Quality assurance plan.

Universal Fibre Yarn Machine—This machine has been developed with the objective of providing an appropriate technological input in the tradition bound village artisan-based small industrial sector. Rope making by manual means using agricultural by-products, such as straw, coir and different grasses is an age-old practice in rural India. The Universal Fibre Yarn Machine replaces the traditional technology of rope making by a mechanized process for improving productivity as well as the quality of the product.

The technology has been released on a commercial basis. CMERI has undertaken the responsi-

bility of manufacturing 100 such machines for distribution in different rural areas of the country. The necessary training for operating the machines has also been imparted.

Twin Screw Press for Extraction of Palm Oil—Introduction of oils from different non-traditional oil-seeds for popular consumption is an effort that has recently been stepped up in view of the ever increasing gap between demand and supply of the commodity.

Developed by MERADO, Chennai, the press for extraction of palm oil has a nominal capacity of processing 5 tonnes/h of fresh fruit bunch and is ideal for medium-sized processing units. It essentially consists of: Pressing section made up of a perforated housing encompassing two helical rotors of variable pitch and rotating at low speed in opposite directions; Hydraulically actuated unit for maintaining the requisite back pressure, which may be varied on requirement; and Drive unit comprising an electric motor and a helical reduction unit for rotating the helical screws. The digested hot mash of the palm fruit is fed to the pressing section through a hopped feed unit and the oil is extracted by the pressing action of the screws,

which is subsequently expelled through the perforated cage.

The project was sponsored by TMO&P. The developed machine has been installed at a plantation in Pedavegi, A.P.

Light Weight Power Tiller—Power tillers presently manufactured in the country are in the range of 8-10 hp and weigh about 400 kg. These are not suitable for cultivation in hilly areas on account of their heavy weight.

The power tiller developed by CMERI is a versatile light weight equipment and is able to accommodate such diversified end-uses as inter-row tillage, water pumping and other agricultural operations.

Fluidized Bed Drying of Oil-seeds—Drying of agrocrops is an important operation in the post-harvest phase. Among the different methods available, fluidized bed drying offers many inherent advantages. CMERI has been working on fluidized bed systems and heat and mass exchange processes for quite some time and has acquired strong expertise in the area. At the instance of TMO&P, the institute has started the work on design and development of fluidized bed dryer for oil-

seeds such as mustard, sunflower, rapeseed, groundnut, etc. The developed know-how shall be extended subsequently to other valuable agrocrops such as spices, tea and coffee, by optimizing the processing parameters. Investigations would be made on an ex-

perimental pilot unit of 100 kg/h capacity for design data generation in the first stage; the design and development of a semi-commercial unit of 2 tonnes/h would be carried out in the next stage.

The pilot unit has been designed and set up. The parameters being studied include feed rate, moisture content of seed, flow rate and temperature of hot air, flow rate and temperature of exhaust air, bed height, bed temperature, pressure drop, etc. Studies on both type of processes, batch type and continuous type, are being investigated to evolve an optimally designed system. Design of a semi-commercial unit is now under progress. Preliminary experimental results obtained with mustard seed are quite encouraging. Considering the expenditure, including capital outlay, depreciation and direct operational costs, initial estimate regarding the cost of processing one tonne of oilseed works out to be around Rs 1000. The optimized fluidized bed dryer is expected to further reduce the cost of processing.

In addition to the semi-commercial unit, a portable unit of fluidized bed dryer will also be designed and developed for remote rural areas.

Single Roll Decorticator for Groundnut—Processing of seeds prior to crushing in the oil expeller requires operations like dehulling/decortication. Conventional dehulling machinery available in the country fail on quality aspects of the delivered end-products, as dehulling is normally not accomplished to the requisite degree by these machines.

With a view to bridging the existing technology gap in this area, the MERADO, Pune, has embarked upon a project which aims at the



Twin screw press for extraction of palm oil

development of an efficient machine for the decortication of groundnut seeds. The development work on the envisaged machine relies upon a single roll for the decortication process. The mode of dehulling is based on shear, compression and impact, whereby direct hitting of the seeds can be avoided and the yield quality improved. Provisions have been made for the control of the dehulling force and the size of the decorticated seeds. The first prototype of the single roll decorticator is being fabricated for a nominal capacity of 2 tonnes/h.

Generic Technology for Expander-Extruders: At the instance of TMO&P, MERADO, Ludhiana, undertook the task of preparing a detailed report on the status of extruder technology in the country, identifying the existing gaps in the technology; Evolving a proper methodology for the development of generic technology aimed at the implementation and absorption of the technology in a scientific way by the user industry; and Developing expander-extruder with dynamic controls for operation at optimum process conditions.

Expander-extruder is the main equipment used in the solvent extraction plants for the preparation of expanded pellets before extraction of oil from oilseeds. Reliability and performance level of existing indigenous expander-extruders leave much to be desired, probably owing to the absence of proper specifications and control of the process parameters, during the extrusion process.

A comprehensive R&D programme has been undertaken for

optimization of process parameters for the processing of different types of major oilseeds, namely cotton seed, groundnut, sunflower seed, mustard/rapeseed, rice bran, etc. for obtaining high quality yield, high oil yielding collets. Control instrumentation is also being developed for automatic control of optimized parameters.

Also, performance improvement of the critical components of the expanding-extruding machines has been undertaken by improving upon their manufacturing metallurgical aspects.

Straw Mattresses and Geo-textiles—Straw mattresses are hard wearing, possessing good air circulation ensuring comfortable temperature and moisture due to better heat and moisture exchange with the environment. The mattresses are compactible and biodegradable.

The technology basically employs multi-needle stitching process to stabilize in place the loose composition and matrix of the filling material, mainly agrowaste such as wheat/paddy straw, evenly spread over a continuous sheet of open weave jute scrim, covered with a similar sheet and the edges folded to close the sides. These mattresses can be produced at a fraction of cost of those manufactured from coir or foam. The mattresses are biodegradable and would find extensive use in hospitals as disposable items, in the railways as low-cost replacements for conventional seat padding, in hotels as an ethnic substitute to normal bedding and for regular domestic use.

CMERI is developing a multi-needle stitching machine for this

purpose. This machine would also be suitable for producing geo-textiles for use in preventing soil erosion on hill slopes. The design work has already been completed and the prototype of the machine is under manufacture.

4-Track, Multi-feeder Single Jersey Circular Knitting Machine—CMERI has undertaken the development of a 30" dia, 4 camtrack, multi-feeder (up to 3 feeders/dia inch), high speed (35 rpm) single jersey circular knitting machine. The proposed machine is to use positive yarn feeders, whereby the effects of yarn tension variation on the stitch length can be overcome and a controlled length of yarn can be supplied to the knitting needles at each feed so as to ensure a uniform fabric quality. Major work pertaining to the development has been completed and the machine is expected to be ready for commercialization shortly.

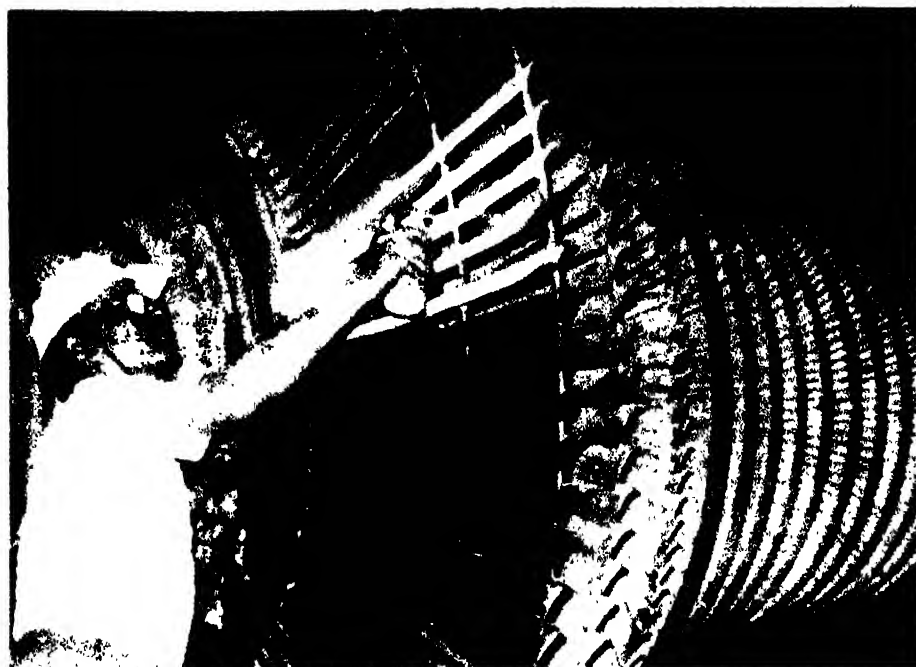
Special Purpose Machine for Manufacture of Heat Transfer Enhancers for Heat Exchangers—It has been found that introduction of matrix tube elements, called enhancers, in between the tube walls and the heat carrying fluid, can reduce or almost eliminate fouling in heat exchanger tubes. This leads to significant improvement in the efficiency of heat transfer, cutting down the operating losses. These enhancers are mostly imported as the indigenous sources for their manufacture and supply are not available. The indigenous availability of matrix elements at competitive price would help Indian industry improve plant efficiency and economic indices of operation. CMERI has undertaken a project for the development

of a special purpose machine for the manufacture of heat exchange enhancers.

Special Purpose Spares and Components—CMERI is carrying out studies related to design and development of typical spares for different process plants. Notable among these are special purpose spray nozzles for continuous casting plants, impellers and runners for power plant fluid couplings, locomotive gear boxes, locomotive air compressors, etc.

Specialized Services Offered

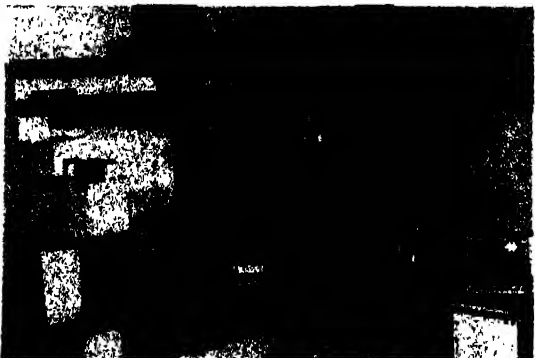
Most of the critical components of a process or power plant in operation are subjected to extreme environmental conditions that degrade the components gradually during service due to one or a combination of time-dependent damage mechanisms such as creep, fatigue, corrosion, erosion, etc.



Residual life assessment work being carried out in a power plant. CMERI has executed work at site for more than 40 power and process plants in the country

Residual Life Assessment— RLA is the most important step in knowing the present status of the components and taking remedial actions for their life extension programme. RLA helps in preventing the premature retirement of plants and their

components, which in turn has important ramifications on the operational and financial aspects of plant performance. In the application area of 'Reliability & Failure Analysis and RLA', CMERI has accumulated a wealth of knowledge and experience over the last three decades. The range of specialized services that CMERI offers in this area include: Dynamic balancing of rotors; Detection of malfunction through signature analysis; Noise monitoring and control; Resonance and natural frequency determination; Quality assurance and metallurgical property determination of engineering materials; Fault and failure mode analysis of materials; System reliability studies; Destructive tests on materials; Contaminant and wear debris analysis; Bearing performance evaluation; Friction and wear measurement; Shock-pulse measurements of rolling element bearings; Detection of cracks and voids; Corrosive thinning and crack depth measurement; Tube thickness and



Facilities available at metrology laboratory (clockwise from top left): Talyrond roundness measuring machine, internal diameter measuring machine, and coordinate measuring machine

coating measurement; Optimal examination of inaccessible surfaces; Investigation of weldments; Rotor stressing and residual stress measurement; and Structural stability analysis.

Quality Assurance—CMERI and its four MERADO Centres have excellent multifaceted infrastructure for quality assurance through testing, evaluation, calibration and standardization. Over the years, the quality of the services rendered by the CMERI family in this field has improved and the breadth of the service interface augmented through the selective induction of new facilities so that the emerging requirements of the industrial sector could be properly addressed to. Such periodic updates of the testing, evaluation, calibration and standardization facilities have placed CMERI in a position where it can cater to the industrial sector through extension of quality services for meeting such imperative conformance conditionalities as those pertaining to ISO 9000 accreditation.

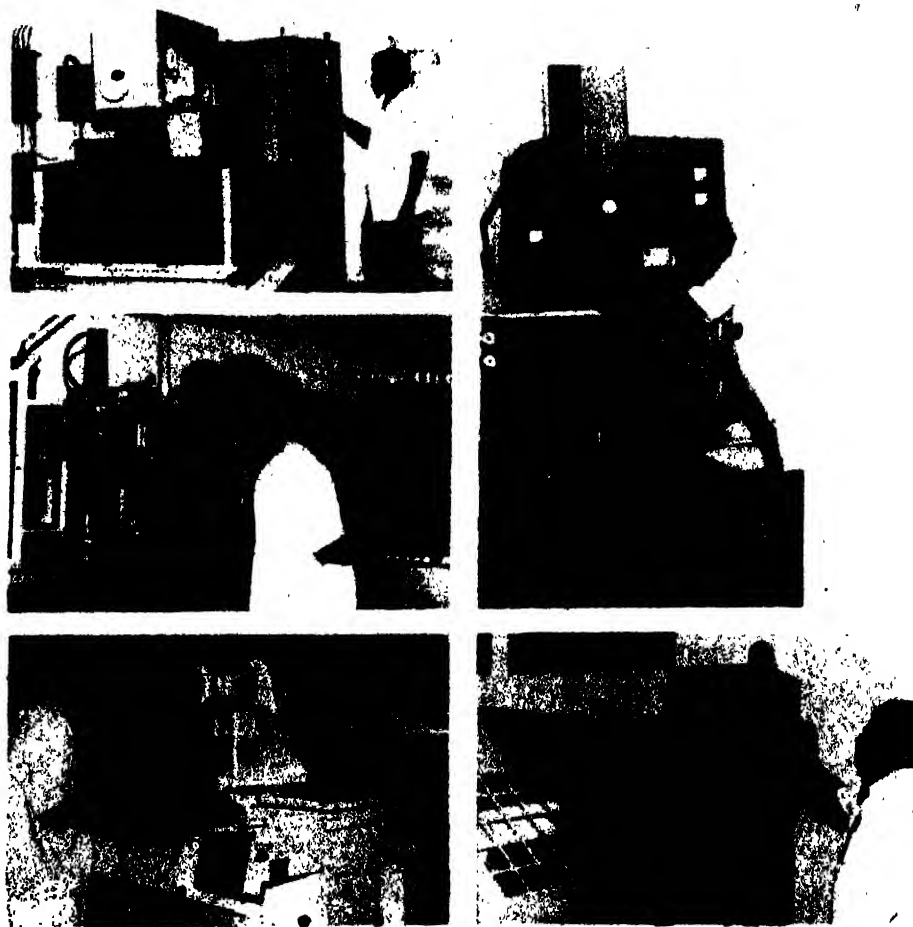
CMERI has excellent testing facilities in the following areas: Metrology; Mechanical testing; Non-destructive testing; Vibration and noise analysis; Metallurgical, chemical and spectrographic analysis; Thermal evaluation; Analysis of fuels and lubricants; Refrigeration and air-conditioning; Filter testing; Tribological analysis; and Pressure testing. In addition, sophisticated facilities exist for calibration of measuring instruments and gauges for dimensional, electrical, thermal and pressure related parameters.

The institute has been authorized to act as an accredited

agency for cylinder testing certification by the Chief Controller of Explosives, Government of India, Nagpur, and entrusted specialized jobs by such premier certification agencies as the Bureau of Indian Standards (BIS), the Defence Research & Development Laboratory (DRDL), RITES, etc. Regular work is being also carried out for systematic performance evaluation of newly developed products for design validation as well as for provision of third-party assurance for product performance and endurance to the end-customer. Facilities are available for performance testing of such products as diesel engines, domestic and industrial sewing machines, irrigation pumps, radiators, automotive

and industrial filters, pressure vessels, gas cylinders, etc.

Beneficiaries — Some of the licensees/sponsors of CMERI technologies/projects are: HMT Limited, Pinjore; Punjab Tractors Ltd, Mohali; Vasantdada Patil Sugar Institute, Pune; Coconut Development Board, Cochin; Kumardhubi Engineering Works Ltd, Kumardhubi; McNally Bird Engg. Co. Ltd, Kumardhubi; Suguna Chemical Products, Hyderabad; Khandelwal Udyog Ltd, Mumbai; Dynacraft Machine Co. Pvt. Ltd, Mumbai; Kirloskar Pneumatic Co. Ltd, Pune; MAMC Ltd, Durgapur; Voltas Limited, Thane; Chloride India Ltd, Calcutta; Vijaya Sewing Pvt. Ltd, Calcutta; Super Machine Tools Pvt. Ltd, Calcutta; Auto Tractors Ltd, Alla-



Tool room facilities available at CMERI (clockwise from top left): CNC wire cut EDM, EDM sinking machine, CNC lathe machine and honing machine

habad; Tea Research Association, Jorhat; CRO, Rangoon, Burma; Technology Mission on Drinking Water; Zenish Machinekraft Pvt. Ltd, Mohali; Friends Auto Industries, Phillaur; Mankoo Machine Tools, Ludhiana; Indo-German Agricultural Sprayers & Pressing Works, Ludhiana; Technology Mission on Oil-Seeds & Pulses; Dhan Laxmi Engg. Enterprises, Karnataka; and Ganesh Trading Co., Latur, Maharashtra.

The major users of the institute's services include: Damodar Valley Corporation, West Bengal State

Electricity Board, Bihar State Electricity Board, National Thermal Power Corporation, Atomic Energy Regulatory Board, Nuclear Power Corporation, Andrew Yule and Co. Ltd, Bharat Heavy Electricals Ltd, Durgapur Steel Plant, Alloy Steels Plant (Durgapur), Bokaro Steel Plant, Rourkela Steel Plant, Tata Iron and Steel Company, Tata Electric Locomotive Company Ltd, McNally Bharat Engineering Co. Ltd, IFB Industries Ltd, Phillips India Ltd, Batliboi and Co. Ltd, Usha Martin Industries Ltd, Hindustan Development Corporation Ltd, and Shriram Fertilizers and Chemicals. □

Projects taken up/completed at NIO

THE new projects taken up and those completed by the National Institute of Oceanography (NIO), Goa, include:

New Projects

- Studies on air-sea interaction processes over the tropical Indian Ocean in relation to summer monsoon using satellite data (Sponsored by Department of Science & Technology, New Delhi; estimated cost Rs 1.1 million).
- Methane and gas hydrates in marine sediments from eastern Arabian Sea: distribution, origin and their possible impact on climate changes (Sponsored by Department of Ocean Development, New Delhi; estimated cost Rs 1.8 million).
- Innovative ideas in Science & Technology (Rajiv Gandhi Research Grant of Rs 200,000 to Dr S.M. Gupta, from Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore).

- Engineering consultancy for the location and design of intake and outfall (Sponsored by the Dabhol Power Company, Mumbai).
- Dredging of river mouths in Goa (Sponsored by the Captain of Ports, Panaji).
- Ecobiological, toxicological and environmental impact assessment studies of the effluent discharge from MRL-CBR in the marine environments off Nagapattinam, Tamil Nadu (Sponsored by the Madras Refineries Ltd, Nagapattinam).
- Baseline studies on ocean currents in the Central Indian Basin prior to benthic disturbance (DOD Grant-in-Aid Project). □

Sponsored/Consultancy Projects taken up by CECRI

DURING November-December 1997, the Central Electrochemical Research Institute, Karaikudi, took up the following sponsored/consultancy projects.

Sponsored Projects

- Electroforming for CUS main engine and steering engine thrust chambers (Liquid Propulsion System Centre, ISRO, Valiamala; Rs 1.7 million)
- Design and fabrication of a parallel plate reactor for effluent treatment (Alagappa University; Rs 55,000)
- Conducting polymer-based flexible antistatic EMI shielding material (Defence R&D Board, New Delhi; Rs 466,000)
- Development of a suitable protective coating system for managing steel components used in the launch vehicles (VSSC, Thiruvananthapuram; Rs 1 million)

Consultancy Projects

- Rendering advice for suitable anti-corrosive paint schemes for EDS shop of Ordnance Factory, Ambajhri (Garrison Engineer, Bhandara; Rs 65,000)
 - In-house training programme on 'Modern Plating Technology' (Bharat Electronics Ltd, Bangalore; Rs 65,000)
- In addition, the institute took up the task for providing technical services pertaining to: (i) Evaluation of sealed lead acid batteries (Base Corporation, Chennai; Rs 27,000), (ii) Evaluation of battery separator tissue (TWIGA Fibre Glass Ltd, Chennai; Rs 15,000) and (iii) Testing of

organo-phosphonate samples for Lignite Corporation, Neyveli; Rs scale formation control (Neyveli 30,000). □

Chrysanthemum and Coleus Show at NBRI

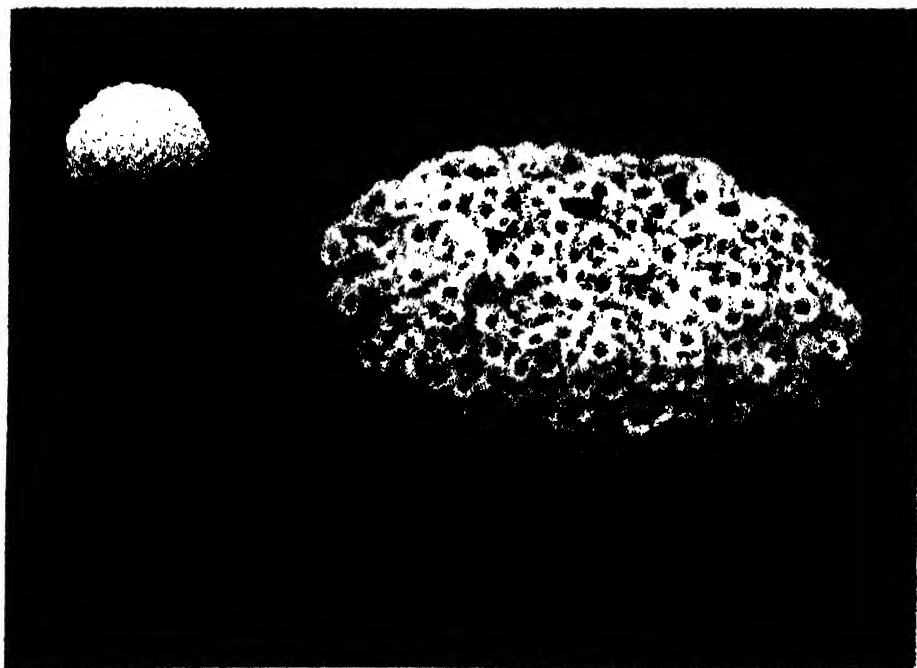
THE National Botanical Research Institute (NBRI), Lucknow, organized the two-day Annual Chrysanthemum and Coleus show at its Central Lawn on 6-7 December 1997. A large num-

ber of chrysanthemums—potted as well as cut flowers, large and small flowers, and arrays of coleuses were displayed on the green lawn of NBRI. This is the only show of its type in Uttar Pradesh and the biggest in the country. It marks the advent of the winter season flowers in North India.

The show was categorized in seven main classes and 123 sections for the competitors and was open to government, semi-government, autonomous bodies and nurserymen. Besides, some sections were open to all and some were restricted for individual groups of ladies. A total number of 122 competitors sent 1087 entries this year. A class-wise break up with total number of entries in each category was: Class A-91, Class B-84, Class C-104, Class D-621, Class E-62, Class F-15, and class G-110. A total number of 385 prizes in addition to 19 running challenge cups, shields and trophies were awarded to the successful competitors.

Some of the arrangements displayed bore attractive themes, e.g.: 'Waiting for Justice', 'Uniformity', 'Blooming Buds', 'Hum Do Hamara Ek', 'Road to Success', 'Polio Tekakaran — 7th December 1997', etc.

Shri Mehmood Ahmad of Shahjahanpur won the Ranjit Singh Memorial Running Challenge Cup for the King of the Show — the best specimen pot of large flowered chrysanthemum in section E-2; Savitri Devi Memorial Challenge Trophy in Class C-1 for 12 pots of 12 different varieties of large flowered chrysanthemums; Shri Ram Kishore Memorial Trophy for the flower of the year 'Kokka Soun' for a specimen pot of large flowered chrysanthemum with single plant bearing single bloom in section E-6; Mehboob Ali Memorial Running



At the Chrysanthemum and Coleus show held at NBRI, Dr S.K. Datta, Scientist, NBRI, explaining to Lt. Gen. Surjit S. Sangra, about the improved varieties of chrysanthemum developed by NBRI, and 'King' and 'Queen' of the show

Challenge Trophy in section E-8 for a collection of 6 pots of different varieties of incurved type large flowered chrysanthemum and Qazi Syed Masood Hasan Running Challenge Trophy for 'The Prince of the Show' for a specimen pot of spider bearing single bloom in section E-4.

Vyavastha Adhikari (Udyan), U.P. Sachivalaya, Lucknow, lifted Percy-Lancaster Running Challenge Cup for the best collection of 9 pots of different varieties of chrysanthemum of Korean types in section E-1, Dr R.V. Sitholey Memorial Running Challenge Cup for the best artistic group of coleus in Class G-3, Shri Devi Shankar Sinha Memorial Challenge Trophy for the artistic group of large flowered chrysanthemum in class G-1 and Mahfooz Ali Memorial Running Challenge Trophy for the artistic group of small, flowered chrysanthemum in class G-2.

Vikramjit Singh Running Challenge Cup for the overall highest scorer in the show, Indian explosives Ltd. (Fertilizer Division) Running Challenge Cup for the highest scorer in specimen pots of chrysanthemum in class D-1 to D-24 and Smt. Madhuri Rai Running Challenge Shield for a set of two best specimen pots of large-flowered and a small flowered chrysanthemum trained in attractive styles in section E-5 were lifted by Head Quarter Central Command, Lucknow.

The winners of the various other Shields/Cups/Trophies were: Smt. Ranjit Singh Running Challenge Cup for the Queen of the Show (the best specimen pot of small flowered chrysanthemum in section E-3) — Smt. K.P. Srivastava of Mahanagar, Lucknow; G.O.C.-in-C—Central Command Running Trophy for the highest scorer in specimen pots of coleus in class D-42-D-50 — Central Command, ADM Branch, Lucknow; Shri Govind Prasad Memorial Challenge Trophy in class C-

4 for 12 pots of different varieties of small flowered chrysanthemum — Shri Abdul Haq of Lucknow; Qazi Syed Hasan Memorial Running Challenge Trophy for the highest score in class F for coloured photographs of chrysanthemum — Shri Raja of Vikas Nagar, Lucknow; Smt. Krishna Devi. Memorial Training Trophy for a collection of 4 pots of different varieties of spider type large flowered chrysanthemum in section E-7 — Shri Surendra Kumar Sharma, Aishbagh, Lucknow; Mohammad Mullick Memorial Running Challenge Trophy in class C, section C-2 for 6 pots of 6 different varieties of large flowered chrysanthemum — Shri Lakhbinder Singh of Rajajipuram, Lucknow; and Begum Saeeda Khatoon Running Challenge Trophy in class D (D-25 to D-31) for the highest score in cut blooms of large flowered chrysanthemum — Km. Shikha Chattree, Dalibagh, Lucknow.

Some of the special features of the R&D at NBRI, on display comprised: Special plants of improved chrysanthemum varieties developed during the last few years. Tissue culture-raised chrysanthemum plants were displayed for the first time. Dehydrated flowers were also on display. To celebrate the 50th year of Independence, a map of India had been landscaped using mini chrysanthemums. A wide array of different colours of chrysanthemums used in the formation and demarcation of different states, indicating the diversity of the people, language and its unity in diversity. Another attraction was the display of new interior decorative items with mini chrysanthemums.

Dr P.V. Sane, the then Director of NBRI, Lucknow, welcomed the Chief Guest, participants and the garden enthusiasts present on the occasion and introduced Lt. Gen. Surjit S. Sangra, VSM GOC-in-C,

Central Command and Smt. Sangra to the distinguished audience. On this occasion, Lt.Gen. Sangra eulogized the efforts of NBRI towards promotion of floriculture in the region. □

TRAINING PROGRAMMES

IIP conducts Training Programme for MRL Chemists

THE Indian Institute of Petroleum (IIP), Dehra Dun, conducted a week-long training programme commencing from 6 October 1997, for the chemists of the Madras Refineries Ltd (MRL), Nagpattinam. Apart from the chemistry of crude oils and their physico-chemical properties, which was the major component of the programme, physico-chemical analysis of fuels, their specifications and significance were covered during the course.

The faculty for the programme consisted of Shri S.K. Chibber, Shri N.K. Pandey, Shri C.B. Nautiyal, Shri U.D. Semwal and Shri P.C. Joshi. Kum. S.K. Chopra, Dr Pradeep Kumar, Shri G.M. Bahuguna and Shri R.K. Chauhan gave training in instrumental techniques.

Dr Himmat Singh, Deputy Director and Area Coordinator of the Training Division at IIP, in his inaugural address, underlined the primary need for refinery personnel to update themselves with the latest technology as they had a great responsibility in view of the increasing quality specifications.

He emphasized the importance of training programmes like the present one as these serve as the vital links between the industry and R&D institutes. IIP was always ready to

resolve any problem faced by the industry, he added.

IIP, Dr Himmat Singh continued, was one of the best laboratories in the sphere of crude and product evaluation in South-East Asia and its faculty was highly competent.

Nine practicals in the standard analysis section, eleven in the crude evaluation lab and some concerning instrumental techniques were part of the programme on crude assay using physico-chemical and analytical methods. □

Course on Blasting Techniques for Mining and Construction Projects

A five-day course on 'Recent Advances in Blasting Techniques in Mining and Construction Projects' was organized by the Human Resource Development (HRD) group of Central Mining Research Institute (CMRI), Dhanbad, during 22-26 December 1997.

Inaugurating the course, Dr S.M. Kolay, Director (Technical), BCCL, urged, "The course participants should not merely act as receiving points during their process of learning. Rather, they should interact to the hilt with the faculty members and point out various problems they

are facing during blasting operations at their respective places of work. All the problems may not have readymade solutions. But, these would give food for thought to the scientists and experts in blasting and that ultimately would lead to solutions". According to him, this is the way technology would improve and industry would be benefitted.

Earlier, Dr P.R. Sheorey, Scientist F, CMRI, while welcoming the course participants, opined, "Blasting is an essential tool which is immensely resorted to by the mineral industry for extraction of coal and

other minerals". According to him, about 80% of the explosive production in India is consumed by the mineral industry for blasting purposes, out of which 70% is shared by the coal industry, he added.

Dr Sheorey also touched upon various recent achievements of CMRI in the field of blasting research. These, he opined, are not only helpful in increasing production but also ensuring safety and economy.

Another important speaker on the occasion was Shri Rahul Guha, Director, DGMS. Shri Guha dealt with Risk Assessment Principles and urged that the industry should reap the benefits of these principles to avoid accident during blasting.

Shri R.B. Singh, Scientist-in-Charge, Blasting Division, CMRI, introduced the course content and Shri R.P. Singh, Scientist-in-Charge, HRD Group of CMRI, proposed a vote of thanks.

The valedictory function of the course was held on 26 December. Dr T.N. Singh, Acting Director, CMRI, gave away the certificates to the course participants. □



Participants of the course 'Blasting Technique for Mining and Construction Projects' with Dr S.M. Kolay (fifth from left—first row); on his right is Dr P.R. Sheorey

NEW PUBLICATIONS

Technologies from CSIR for Madhya Pradesh

THE Polytechnology Transfer Centre (PTC), Bhopal, has made commendable efforts towards transfer of CSIR technologies in the State of Madhya Pradesh and transferred about 150 technologies. The PTC has now compiled and published a booklet containing information about 225 CSIR technologies mentioning requirement of raw materials, project cost, applica-

tion uses, etc. regarding these technologies appropriate for Madhya Pradesh. The booklet 'Technologies from CSIR for Madhya Pradesh' was released by the Chief Minister Shri Digvijay Singh on the occasion of 23rd annual general body meeting of Federation of Madhya Pradesh Chambers of Commerce & Industries (FMPCCI) at Udyog Bhawan, Bhopal, on 2 December 1997. □

Honours & Awards

Dr Krishan Lal

In recognition of his outstanding contributions to the field of electronics and electronics materials as well as international cooperation, Dr Krishan Lal, Director Grade Scientist and Head of the Materials Characterization Division, National Physical Laboratory (NPL), New Delhi, has been elected a full member of the International Academy of Electrotechnical Sciences (IAES), Russia. The President of IAES, Prof. Valery A. Altov, has invited Dr Krishan Lal to be the President of the Indian branch of the academy that it proposes to set up at NPL.

Also, the Science Council of Institute of Inorganic Chemistry, Siberian Branch of Russian Academy of Sciences, has elected Dr Krishan Lal an Honorary Doctor of the institute, in consideration of his outstanding achievements in science and significant contribution to establishing international cooperation.

Dr M.V.A. Murthy

DR M.V.A. Murthy of the Propulsion Division of National Aerospace Laboratories, Bangalore, has been elected Fellow of the Aeronautical Society of India.



Shri Digvijay Singh, releasing the booklet 'Technologies from CSIR for Madhya Pradesh', compiled by PTC, Bhopal



Ms M. Kousalya receiving the 'Engineer of the Year Award-1997' from Er. K.V. Chowhal, President, Institution of Engineers

Ms M. Kousalya

MS M. Kousalya, Scientist, National Geophysical Research Institute, Hyderabad, has received the prestigious Engineer of the Year Award 1997 for her work in the field of Instrumentation. This award was instituted by the Government of Andhra Pradesh and the Institution of Engineers (India), A.P. State Centre.

Ms Kousalya is actively engaged in applying geophysical techniques to archaeological exploration, and is associated with geophysical instrumentation development projects. Her most recent contribution is the development of Automatic Pump Control by sensing salinity. The instrument will help in keeping aquifers in coastal areas from becoming brackish by providing necessary warning/control before salt water intrusion occurs. □

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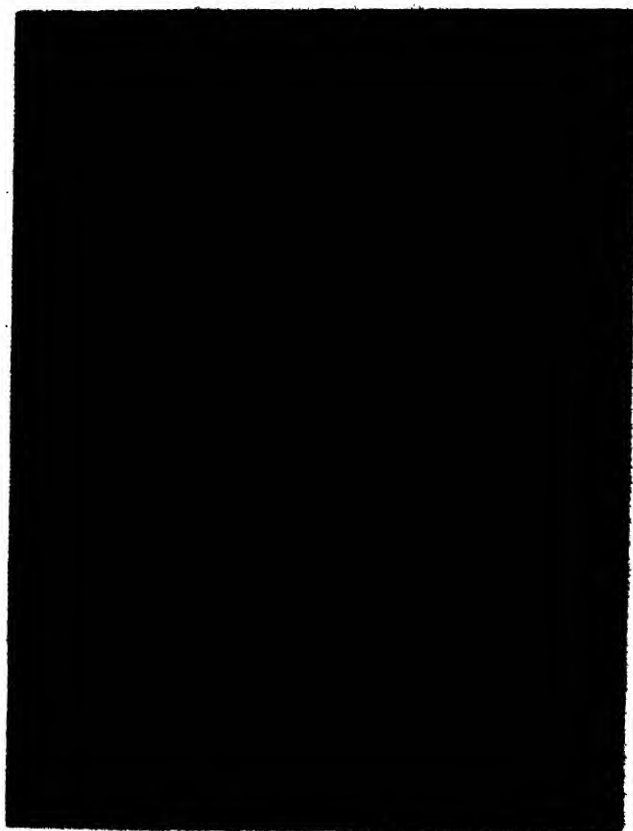
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CSIR NEWS



Structural Engineering Research Centre, Ghaziabad's R&D activities : (clockwise from top left) Non-destructive testing of framed structures, Comparative performance investigation through embedded and surface mounted strain gauges, Exploitation of ferrocement as wood substitute, and Pullout test device in use at Narora Atomic Power Station (p. 57)

Sethusamudram Ship Canal Project

INDIA does not have, within her own territorial waters, a continuous navigable route around the peninsula due to the presence of a shallow (3.5 m) coral reef called 'Adams Bridge' at Pamban near Rameswaram between the south-eastern coast of India and Talaimannar of Sri Lanka. Consequently, the ships calling at ports on the east coast of India have to go around Sri Lanka, increasing the distance covered by more than 400 nautical miles and involving an additional 36 hours of ship time.

In the past over a century, several proposals for a ship canal across Rameswaram have been formulated by the Government of India and Government of Tamil Nadu, aimed at connecting the east and west coast of India. The last such proposal formulated in 1983 by a sub-committee of experts in harbour

engineering and navigation under the chairmanship of the then Development Adviser (Ports), Government of India, recommended an alignment near the Kodandaramaswamy temple at Rameswaram, after taking into consideration the views and issues brought up by the local public, the fishermen, and the pilgrims. The report has since been updated in 1996. The Sethusamudram Ship Canal Project envisages construction of a ship canal of varying lengths to suit different drafts (30', 31' & 35') through dredging/excavation, a lock of suitable size, a bridge, breakwaters; and other infrastructural facilities. The estimated capital cost (1996 price) of the project is Rs 6850 million, Rs 7600 million and Rs 12000 million for 30', 31' and 35' draft respectively.

In keeping with the Ministry of Environment & Forests, Government of India's guidelines for port and harbour projects, the Ministry of Surface Transport, Government of India, has decided to incorporate environmental considerations in the design of the project so as to ensure that the proposed development is in harmony with the region's environment and ecology. Towards meeting this objective, the Tuticorin Port Trust (TPT), the nodal agency identified for implementation of the project, has retained the National Environmental Engineering Research Institute (NEERI), Nagpur, to conduct initial environmental examination (Phase I), and a Comprehensive Environmental Impact and Risk Assessment (Phase II).

The scope of study comprises delineation of the baseline environmental status in the project area;



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The proposed project, when implemented, is expected to result in a surge in coastal trade; development of industries in the hinterland districts of Tamil Nadu, viz. Ramanathapuram, Pasumpon Muthuramalingam and Tuticorin; spurt in the export of marine products; development of thermal power stations and refineries at Tuticorin, Thiruvananthapuram, Kochi and Mangalore; and foreign exchange earnings to the tune of Rs 350 million/annum in addition to a reduction in petroleum products import bill of over Rs 400 million. □

The scope of the MoU includes:

• Other studies

Consultancy/Sponsored Projects taken up/completed at SERC-Chennai

Consultancy Projects taken up

- Investigation on water leakage and corrosion in 'C' Block of Legislature Building of PWD, Kerala, and recommendation on remedial measures (PWD, Kerala, Thiruvananthapuram).
- Inspection of fire-affected lift wells in Anna Road Telephone Exchange Building (Department of Telecommunications, Electrical Circle, Chennai).
- Checking the design and joint details of 80 m self-supporting tower, including proof checking of designs for ONGC Sagar Laxmi Modification Project (M/s Larsen &

NAL'S Flosolver now accessible on the Kodihalli Campus Network

THE National Aerospace Laboratories (NAL), Bangalore's parallel super computers, Flosolver Mk3 and SuperSolver can now be accessed on the Kodihalli campus network. Interested users can login as 'guest' and obtain access at the following IP addresses:

Flosolver Mk 3

(Intel's i860 processor, 64 MB per processor)

flo1 202.41.65.133

flo2 202.41.65.134

flo3 202.41.65.135

SuperSolver

(SGI's R8000, 64 MB per processor; these nodes can be used either as sequential machines or as a 4-processor parallel machine)

challenge1 202.41.65.136

challenge2 202.41.65.137
(320 MB)

indigo1 202.41.65.138

indigo 12 202.41.65.139 □

Toubrro Ltd, Oil & Gas and Special Projects, Mumbai).

- Preliminary design of reinforced concrete natural draught cooling tower [M/s Balcke Duerr and WABAG Technologies Limited (BDAG Group), Chennai].
- Evaluation of fatigue characteristics of cam chain (M/s TI Diamond Chain Ltd, Chennai).
- Load testing of PSC girders in MRTS railway track under moving loads (IRCON International Ltd, Chennai).
- Checking the design of supporting structure of ESP at Tenughat Power Project (Bharat Heavy Electricals, Ranipet).
- Assessment of quality of the reinforced concrete service building structure (Nuclear Power Corporation, Madras Atomic Power Station, Kalpakkam).
- Dynamic experiments on single and seven subassembly mockups (Indira Gandhi Centre for Atomic Research, Kalpakkam).

- Assessment of structural integrity of the RC dome of the wave energy caisson at Vizhinjam near Thiruvananthapuram and recommendations for repair measures (National Institute of Ocean Technology, Chennai).
- Experimental assessment of load carrying capacity of 132 kV, S/C monopole structure (Larsen & Toubrro Ltd, Chennai).
- Checking the design and joint details of 100 m MW tower (IMI Software Ltd, Hyderabad).
- Analysis and design of new profiles for 8" gas pipeline in service (Gas Authority of India Ltd, New Delhi).
- Investigations on the flyover bridge of Visakhapatnam Port Trust, Visakhapatnam.
- Performance evaluation of ROPS cabin of earth moving equipment (Hindustan Motors Ltd, Tiruvalur).

Consultancy Projects completed

- Fatigue strength evaluation of piston rods (Larsen & Toubrro Ltd, Bangalore).
- Investigation on the vibration problems of the 210 MW TG foundation columns and recommendation for remedial measures (M/s Neyveli Lignite Corporation, Neyveli).
- Checking and approving the analysis and design of 69 m span industrial shed (M/s Krupp Industries India Ltd, Pune).
- Failure investigation of microwave tower at Ravulapalem (Department of Telecommunications, Hyderabad).
- Selection of type of pile foundation for buildings for static loading (M/s GMR Vasavi Power Corporation Ltd, Chennai).
- Impact-resistant design of R.C. base structure for a forge hammer machine (M/s Master Forge (India) Pvt. Ltd, Chennai).
- Checking the design and joint details of 70 m MW / telecommunication tower (M/s Hara Industries, Hyderabad).
- Experimental assessment of load carrying capacity of 132 kV, S/C monopole structure (M/s Larsen & Toubrro Ltd, ECC Construction Group, Chennai).
- Mechanical strength assessment of a 800 kV vee string insulator (M/s BHEL Electro Porcelain Div., Bangalore).
- Checking the design and joint details of 90 m self-supporting tower including foundation checking (M/s Towercon (I) Designers Pvt. Ltd, Hyderabad).

- Fatigue life evaluation of cam chain (M/s TI Diamond Chain Limited, Chennai).

Sponsored Projects completed

- Investigation on the suitability of square/rectangular hollow section for the design of transmission line (M/s Tata Iron & Steel Co. Ltd, Calcutta).

- Interactive computer software for analysis and design of ships and ship structure (CODES-I) (Hindustan Shipyard Ltd, Visakhapatnam).

Also, the SERC completed a grant-in-project of the Department of Ocean Development, New Delhi, on Corrosion fatigue behaviour of offshore tubular joints. □

Formation of Consortium of R & D Institutes and Industry in the Area of Optical Thin Film Devices

A meeting of R&D institutes and industry working in optical thin film devices was held at the Central Scientific Instruments Organisation (CSIO), Chandigarh, on 10 January 1998. Scientists & technologists from Indian Institute of Science (IISc), Bangalore; Instrument Research & Development Establishment (IRDE), Dehra Dun; National Physical Laboratory (NPL), New Delhi; CSIO; Opto-Electronic Factory (OLF), Dehra Dun; Bharat Electronics Ltd (BEL), Machilipatnam, and Instrument Design & Development Centre (IDDC), Ambala

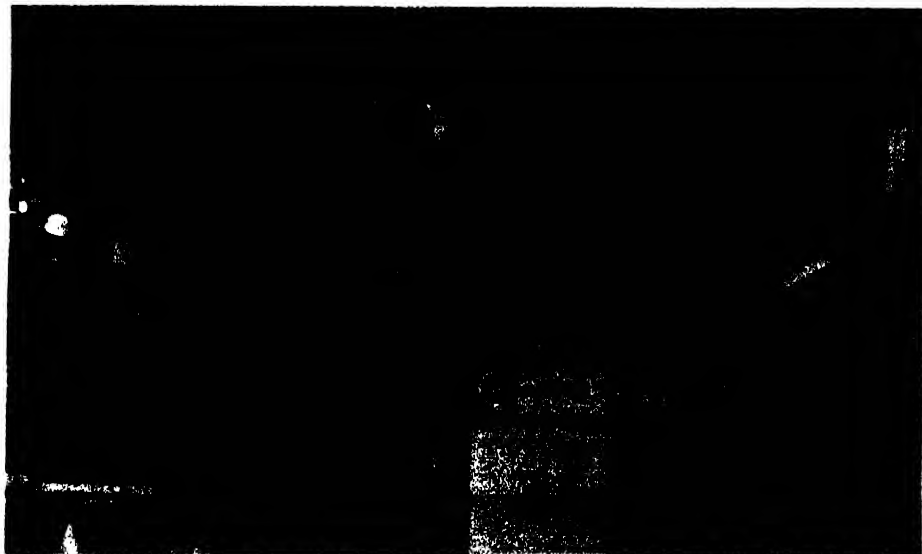
Cantt. attended the meeting. A consortium of these institutes/industrial outfits was formed during the meeting.

Prof. S. Mohan, Director, CSIO, chaired the meeting. In his introductory remarks, Prof. Mohan spelled out the objectives of the consortium, which were mainly the consolidation of diverse capabilities of the constituent groups and effectively planning the realization of professional optical thin film devices.

SWOT analysis of the constituent group's activities was carried out and gaps in optical coating design,

material aspects, processing and characterization capabilities as also the requirement of training and hiring of consultants were identified. It was gratifying to learn about some of the impressive achievements made by the consortium members. This included development of 'Head-up Display System' by CSIO. The development of thin film beam combiner component given to IISc group has made an impressive progress. OLF was initially involved in this development and utilizing its extensive infrastructure, the first prototype had been demonstrated. This technology has since been transferred to BEL, Machilipatnam, for commercialization. OLF demonstrated 2 gigawatt damage threshold for laser mirrors manufactured by it. NPL group demonstrated high-performance large-area diamond-like carbon coating technology for use at IRDE for thermal imaging applications. A sophisticated PECVD facility designed & developed by the laboratory has also been transferred to IRDE. IISc group has developed a range of techniques for ion-assisted deposition of optical thin films for future use at the manufacturing units of the consortium. It was felt that CSIO and IDDC have very efficiently used their limited resources to offer a wide range of optical coating services. Similarly, IRDE group demonstrated performance of AR coating in the visible and infrared region, making use of software developed by the establishment.

During the meeting, various sub-groups were identified for carrying out R&D work in different specialized areas. This includes thin film coating design; advanced deposition techniques like ion plating, plasma polymerization, reactive magnetron R.F. sputtering, etc.; fab-



Meeting for formation of 'Consortium of R&D Institutes and Industry in the Area of Optical Thin Film Devices' in progress

rication of thin film devices like infra-red filters, anti-glare night driving goggles, ultra stable and very narrow band filters for WDM and other applications. Needs for characterization of optical thin films by various innovative techniques like optical fibre-based scatter measurement, photo deflection spectroscopy for low optical absorption, FTIR, ellipsimetry, etc. were empha-

sized. Various marketing strategies needed to make the consortium financially successful were also discussed.

Consortium members felt that given proper encouragement and funding they could develop internationally competitive optical coating technologies and enter export business.

□

Industry - User - R&D Interaction Meet on Bio-medical Instrumentation for Health Care

THE Central Scientific Instruments Organisation (CSIO), Chandigarh, organized an Industry-User-R&D Interaction Meet on Bio-medical Instrumentation for Health Care, from 22 to 24 December 1997, with the following objectives :

- To identify and consolidate the strengths and efforts of the organizations involved in any of the key aspects of medical instrumentation, viz. R&D, S&M, HRD
- To identify directions for futuristic R&D and evolve a mechanism for collaborative working involving all the concerned players
- To develop an organizational structure and to formulate guidelines for tackling the national problem of instrument maintenance
- To evolve a framework for Human Resources Development with a view to creating a reservoir of trained manpower in medical instrumentation
- To work out the modalities of forming a consortium among the concerned players with a view to guiding and directing the medical instrumentation activity

Inaugurating the Interaction Meet, Dr R.A. Mashelkar, Director General, CSIR and Secretary to the Government of India, highlighted the problems which the medical instruments industry in the country is facing. The liberalization of the Indian economy has led to intense competition with the result that the industry has lot of challenges before it. For instance, with the coming up of multi-nationals, only those who have their own strength will be able to survive. The strength comes through excellence, be it in terms of product quality, its innovativeness vis-a-vis other products not only in the Indian market but in the international market, distribution channels or after sales support. Dr Mashelkar emphasized the need for innovativeness in manufacturing technology. Stressing the importance of partnership in innovation, he pointed out that 50% of the ideas for new innovations come from the users. This has happened not only in medical electronics but in bio-technology and textile machinery as well. Innovation is a continuous process and there are progressive

companies which go on displacing their own products through newer innovations, thus leading to shortening of product life cycles.

Dr Mashelkar exhorted the scientists to think in a borderless way which means widening the spectrum of applications of a technology in different areas, particularly in medical instrumentation. He quoted the example of computer technology pervading almost all fields of medical instrumentation, particularly imaging.

Dr Mashelkar also released the technical know-how of the following medical instruments developed by CSIO to the industries:

- Pulse Oximeter [released to Pranavam Life Care Instruments Pvt. Ltd, Ernakulam]
- Drug Infusion Pump and Controller [Pranavam Life Care Instruments Pvt. Ltd, Ernakulam; Soimit Electronics & Medicare Systems (P) Ltd, SAS Nagar; Environmental & Scientific Instruments Company, Panchkula; and Bergen Electronics (P) Ltd, Gurgaon]
- Servo Controlled Baby Care Incubator [Bergen Electronics (P) Ltd, Gurgaon]
- Resuscitation Bag for Neonates [Soimit Electronics & Medicare Systems (P) Ltd, SAS Nagar]

Prof. S. Rame Gowda, Chairman, AICTE, highlighted the importance of trained manpower in medical instrumentation, particularly in maintaining the medical equipment. Earlier, Prof. Rame Gowda also released a souvenir brought out on the occasion.

Shri A. Shanker, General Manager (Operations), WIPRO, GE Medical Systems, who delivered the



Dr R.A. Mashelkar delivering his inaugural address during Industry-User-R&D Interaction Meet on Bio-medical Instrumentation for Health Care, and a view of the audience

key-note address, recounted the success story of WIPRO GE in India.

During the Meet, following conclusions were drawn :

Research & Development

It was strongly felt that to be internationally competitive, consortia approach to R&D was a dire necessity. The member companies of the Medical Equipment Division of the Confederation of Indian Industry (CII) as also other companies present in the Meet felt that a strong nationwide R&D base be made possible out of networking the industry, the users and the R&D organizations with government acting as a catalyst, which should serve as a fountainhead of the medical instruments industry development. This is a crying need of the hour and our inability to act on this will lead to our lagging behind the foreign industry, both technologically and strategically. It was, therefore, felt that the industries and users, that is the doctors, should be part of the R&D team right from the day a project is conceptualized. This team should continue till the logical conclusion of the project. Such an approach, be-

sides accelerating the pace of R&D, will also quicken the process of technology transfer.

In order to productionize the technologies quickly, there was an imperative need for process engineering which covers manufacturing technology involving tooling, dies, moulds jigs & fixtures, QC & QA procedures and packaging in a customer-friendly manner, etc. The R&D organizations should provide all the necessary backstopping support to the know-how taking indus-

try till the time the product is launched successfully into the marketplace.

There was an agreement that in view of rapid obsolescence in Medical Instrumentation, the R&D should be a continuous process and that the companies should be prepared to spend at least 10-15% of their sales turnover in R&D.

There was consensus that before undertaking development, efforts should also be made to look into the requirements of medical instru-



Dr R.A. Mashelkar handing over document of one of the CSIO technologies released during the Industry-User-R&D Interaction Meet on Bio-medical Instrumentation for Health Care

ments which have demand not only within the country but also in other countries of South-East Asia as also Third World countries.

Following areas for collaborative R&D in medical instrumentation were identified :

- (i) Colour Doppler System
- (ii) Phased Array Transducer-based Ultrasonic Scanner
- (iii) Digital X-ray Imaging System
- (iv) X-Ray Image Intensifier System
- (v) Multiparameter Patient Monitoring System
- (vi) Multichannel ECG Machine
- (vii) Transducers & Sensors for dedicated applications in medical instrumentation
- (viii) Ventilators
- (ix) Auto Analyzers
- (x) Neuro-Endoscopes
- (xi) Neuro-Lasers
- (xii) Low-cost Cardiac Catheterization Labs
- (xiii) Pulmonary Function Testing Equipment
- (xiv) Echo Cardiography Systems
- (xv) Automation Film Processors for Radio Diagnosis

There was unanimity that one of the weak areas in Medical Instrumentation which needed immediate attention was that of Sensors and Transducers. It was felt that a dedicated group comprising experts from industry, academic institu-

tions, and R&D organizations be constituted to activate this area.

It was expressed that the software for medical applications is an area having immense potential, particularly when most of the medical instruments were computer-based. Efforts should also be made to create expertise in Clinical Information Systems.

It was felt that a database be created in respect of those technologies which may have bearing on medical instrumentation for specific applications.

Emphasis was also laid on equipment standardization, calibration, and safety.

It was also expressed that either a forum on the lines of Association for Advancement of Medical Instrumentation (AAMI) of USA should be created or a Chapter of the same association be set up in the country for educating the users on procurement of medical instruments.

It was agreed that CSIO should bring out a Source Book on medical instruments produced in the country, which should also provide profiles on the industries manufacturing such equipment.

Repair and Maintenance of Instruments

With regard to the problems of instruments maintenance, it was felt that lack of availability of funds with hospitals, spares, documentation and trained manpower were the major bottlenecks for the vast majority of equipment lying unused in the hospitals and nursing homes.

It was strongly felt that CSIO and CII should jointly undertake an exercise for identifying the medical instruments lying unused in various hospitals and nursing homes for want of expert services and should make joint efforts to put these instruments in working order.

With regard to AMCs, it was generally felt that although automatic continuation of existing contracts was a dire necessity, the hospitals do not have requisite budget to maintain the continuity. Many a times, even the head of the institution signs the AMC after a considerable delay. The industry and the users felt that CSIO in collaboration with CII should take a major initiative; a dialogue with the Health Ministry of Government of India, in this direction was a dire necessity.

A central body like CSIO should be given necessary powers to inculcate accountability among the organizations undertaking to provide such services.

Human Resource Development

It was felt that there was an acute shortage of trained manpower both for R&D and production on one side and instruments maintenance on the other.

The curriculum development in this area needs to be undertaken in consultation with the industries producing medical equipment and doctors and that AICTE should be requested to take initiative in this regard.

There was consensus that although efforts made by CSIO and a few other organizations in generating cadre of private entrepreneurs

by conducting Entrepreneurial Development Programmes in repair & maintenance of medical instruments were praiseworthy, these efforts were infinitesimally small and need to be supplemented further. A policy framework covering incentives both for trainer organizations having requisite expertise as also for the prospective entrepreneurs be evolved.

General

The Medical Equipment Division of CII informed that it was

evolving a mechanism for regular interaction with R&D organizations like CSIO, users and government and frequency of such interactions will be once every quarter.

In order to take stock of the gains accruing out of the interaction meet and to consolidate the efforts made so far, Director, CSIO, suggested that the next meeting of the Medical Equipment Division of CII should be held at CSIO.

The Interaction Meet was co-sponsored by CSIR, TIFAC, DST, DoE and AICTE. The Medical Equip-

ment Division of the Confederation of Indian Industry played a lead role. About 25 industries, manufacturing state-of-the-art medical equipment in the country, academic institutions like IIT, Delhi; Thapar Institute of Engineering and Technology, Patiala; Indian Institute of Science, Bangalore; R&D organizations like NPL, SAMEER, NPOL (DRDO), various government departments (DST, DoE), UNICEF, TIFAC, Indo-French R&D Centre and top doctors in the Country attended the Meet. □

STRUCTURAL ENGINEERING RESEARCH CENTRE, GHAZIABAD R&D Capabilities

THE Structural Engineering Research Centre (SERC), Ghaziabad, is primarily engaged in application-oriented R&D employing advanced engineering concepts, covering a wide spectrum of problems in the areas of: Bridge Engineering, Disaster Mitigation, Material Sciences, Special Structures, Tall Structures, and Wind Engineering. The R&D objectives are sought to be achieved through the most appropriate techniques, viz. analytical modeling, computer simulation, wind tunnel investigations, laboratory investigations, prototype testing, field instrumentation and long-term monitoring, field surveys, etc.

The Centre has built up a rich infrastructure and capabilities on several fronts. A large repertory of computer software, expertise and equipment for large-scale field instrumentation, wind tunnel testing and model instrumentation are a few examples. The Centre has been able to attract sponsorship for a large

number of major projects dealing with analysis, design and long-term performance monitoring of structures. And through continuous interaction with user agencies and departments and professional bodies, e.g. Bureau of Indian Standards, Indian Roads Congress and Ministry of Surface Transport, the Centre provides considerable R&D inputs to the solutions of problems in the area.

The major R&D capabilities and facilities available at the Centre include:

Bridge Engineering

The Centre has rich expertise in conventional areas of analysis and design, computer software and laboratory investigations in the field of bridge engineering. The thrust areas of research relate to performance monitoring, durability and rehabilitation, etc. of bridges.

To foster closer and more active linkages with the industry, CSIR sometime back took an important

step to offer services to the industry through one window, namely the CSIR Multi-lab Bridge Engineering Services (CBES), by combining the strengths of following laboratories engaged in one or more areas of Bridge Engineering, viz. SERC, Ghaziabad; Central Road Research Institute (CRRI), New Delhi; Central Electrochemical Research Institute (CECRI), Karaikudi; and Central Building Research Institute (CBRI), Roorkee. SERC has been identified as the nodal laboratory for this coordinated programme. The range of areas covered by CBES include: bridge substructures and foundations, soil investigations, pile integrity testing, load testing and assessment of load carrying capacity of bearings, joints, corrosion, durability, material degradation, residual life, etc.

Capabilities available at the Centre relate to: 1. *Structural Analysis and Design*—Analysis and design of complex RC and PC bridges of open or closed box cross-section, straight, skew or curved in space, proof-checking of designs; Non-lin-

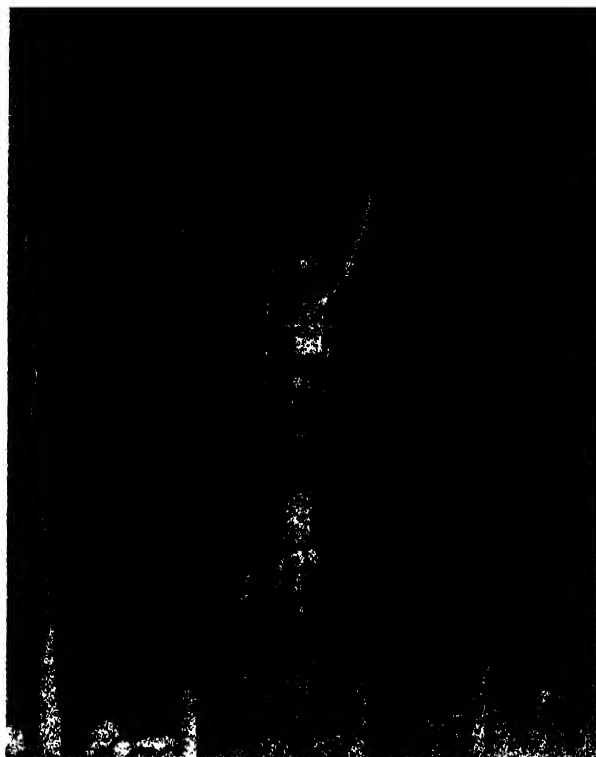
ear analysis and post-cracking behaviour, residual load carrying capacity; Estimation of wind-induced forces and aeroelastic design; Dynamic analysis and earthquake-resistant design; 2. *Software Development*—Development of dedicated CAD software packages; Software capability for bridge-specific problems; 3. *Laboratory Investigations* — Testing of models/prototypes of innovative designs and rehabilitation schemes; Fatigue tests on bridge components; Tests on bearings; Material tests using Non-Destructive Techniques (NDT); 4. *Field Investigations* — Live load surveys; Investigations on distress/failure; Studies on appropriate schemes for rehabilitation, strengthening and retrofitting; 5. *Bridge Instrumentation* — Instrumentation for 'Smart' structures during construction; Development of instrumentation schemes for bridges in-service; Installation of instruments/sensors; Long-term performance monitoring and related software; 6. *General* — Proof-checking of rehabilitation, strengthening, retrofitting; Technical evaluation of consultancy bids; and Evaluation of post-repair performance.

The in-house R&D projects under investigation relate to Expert sys-

tem for distress diagnostics of RC and PC T-Girder bridges; Performance of bridge structures after corrosion of prestressing cables. Studies under the sponsored projects include: Performance monitoring through instrumentation of the Ganga bridge at Varanasi; Instrumentation of simply supported prestressed concrete superstructure (New and recommissioned Old Mandovi bridges at Goa); Instrumentation regarding superstructure of the proposed Airoli bridge, New Bombay. A consultancy project 'Monitoring of the first and second Thane Creek Bridges at Bombay' has also been taken up.

Disaster Mitigation

Natural disasters such as earthquakes, cyclones and floods unleash violent forces, causing destruction of life and property on a colossal scale. SERC has identified Natural Disaster Mitigation as a high-thrust area and the studies in



Pressure cell and rebar load gauge installed at a site

the area aim at evolving practical solutions to the problems of the damage caused to typical man-made structures in disaster-prone regions of the country by evaluating the impact of forces generated by natural hazards on these structures. Investigations on the nature and mechanism of damage vis-a-vis the type of construction and the devel-



Vibration monitoring of Mandovi Bridge at Goa, and vibrating wire strain gauges and temperature gauges installed in Ganga Bridge Superstructure

opment of appropriate mitigative/retrofit measures are also carried out.

Capabilities exist for: Post-disaster field surveys on structural damage assessment due to cyclones and earthquakes; Construction of cyclone-resistant low-rise buildings; Design of earthquake-resistant buildings and bridges; and Dynamic response analysis of structures subjected to base excitation.

The in-house projects underway are: 'Assessment of forces induced due to cyclones on buildings' and 'Seismic effects in bridges and their mitigation'.

Material Sciences

Over the years, the Centre has developed considerable expertise in several allied areas, of which the successful development of ferrocement components is the most outstanding example. Pioneered more than two decades ago, the techniques for the production of a variety of ferrocement products have made a notable contribution towards encouraging entrepreneurship in the manufacture of utilities for low-cost and rural applications.

Capabilities exist for: Design and development of technical know-how for ferrocement structures, components and utilities for housing, sanitation, storage, energy, water supply and waste disposal (bins, tanks, bio-gas digesters, septic tanks and two-pit latrines and toilets, manhole covers, door frames and shutters, roofing units, partition walls, cupboards, dwelling units, water proofing and rehabilitation of RCC and masonry structures); De-

velopment of mechanized process for producing ferrocement/fibre reinforced or reinforced concrete precast elements; Laboratory investigations on concrete and other construction materials for evaluating their strength, durability, long-term performance, acceptance criteria and specification compliance; Field testing of concrete structures for strength and performance evaluation through non-destructive and other invasive and non-invasive techniques; Rehabilitation and strengthening methods/techniques for structures distressed due to various causes; Technology dissemination through specialized courses-cum-field demonstrations and structural elements produced using these materials.

The in-house projects underway relate to: Assessment of strength prediction by early age tests on concrete for quality assurance; Development of precast ferrocement modular system (including wall, roof and other elements) for low-cost houses and utility buildings like small dispensaries, schools, godowns, etc. in rural and urban areas; Development of rain-water harvesting techniques and site-specific ferrocement applications for solving the water and sanitation problems in difficult priority areas; Development of ferrocement structures as a part of the Oil Seed Mission Project (capacities above 20 m³) for the storage of oil seeds, pulses, grains, etc.; Corrosion assessment and protection of reinforced concrete structures; Societal programmes involving water, rural sanitation and low-cost housing for CSIR Action Plan and Rajiv Gandhi National Drinking Water Mission projects.

The sponsored projects relate to: Techniques for using flyash for the development of land in the village Dhirpur, Delhi; Development of ferrocement door frames, shutters and other items as wood substitute; Housing schemes using precast ferrocement, beam and column elements for rehabilitation of earthquake victims of Latur earthquake in Maharashtra.

The consultancy projects taken up include: Strength evaluation of concrete for T.G. foundations for gas generation at BHEL; Evaluation of aerated autoclaved concrete products for Ballarpur Industries Ltd, Palwal; Strength assessment of the reinforced concrete hospital building of Rohtak Medical College, Rohtak; Rehabilitation measures and guidance for quality control operations for the Rohtak Medical College Hospital buildings; Design of rain-water harvesting system and low-cost sanitation units and demonstration of these technologies to Council of Science Technology and Environment, Government of Himachal Pradesh, Shimla; Design of ferrocement structures and rain-water harvesting schemes for Andaman & Nicobar, for UNICEF, Calcutta; Studies on design for 'Janta biogas plant' for Planning, Research and Design Division of State Planning Institute, Lucknow; Bringing out monographs on F.C. tanks and roofing units, for International Labour Organization, New Delhi; Development of designs of ferrocement units like check dams, roofing units, underground tanks, etc. for National Drinking Water Mission, Government of India; Demonstration of construction techniques for rain-water harvesting systems and ferro-

cement tanks at various locations throughout India under the National Drinking Water Mission.

Special Structures

Modern technological applications increasingly bring forth structures of considerable complexity and require more and more sophisticated approaches for their design. With the powerful computational facilities and extremely versatile software now available, virtually any effect can be accounted for without undue computational effort and time. These potent tools could be profitably used to enhance understanding of complex structural effects, to improve the quality of designs both from safety and serviceability considerations.

The capabilities of the Centre in the area comprise: Analytical modeling, development of design methodology and numerical tools for the static and dynamic behaviour of complex continuum structures such as large-box girders, cooling towers, chimneys, storage structures and nuclear pressure vessels; Modeling for special effects such as dynamic loading, non-linear and post-crack-

ing behaviour, soil-structure interaction, creep and shrinkage, temperature effects, impact and blast loading, etc.; Development of realistic models for material constitutive relations based on true material behaviour, tension stiffening and strain hardening; Distress investigations, strength assessment, retrofit and restoration of monumental buildings; and Performance monitoring and non-destructive testing.

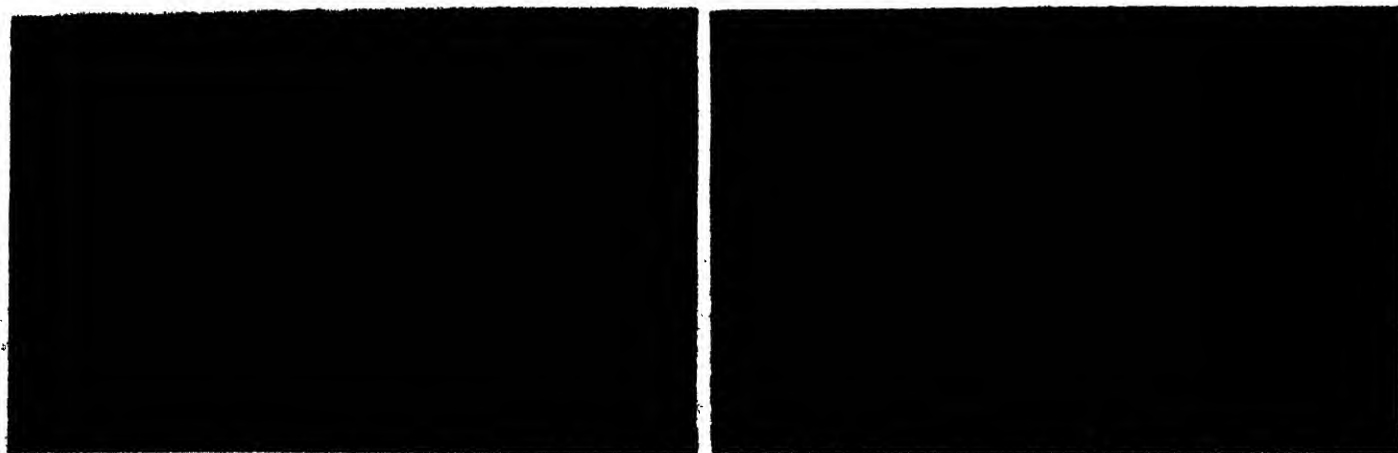
The current in-house R&D projects relate to; Studies on the behaviour of concrete structures under secondary loading like creep and shrinkage; Non-linear behaviour of concrete structures under impact and blast loadings; and Grouting and its performance evaluation as retrofit. The sponsored projects underway include: 'Performance studies on the superstructure of Taj Mahal' and 'Study of Mahadev Temple (Khujaraho) under aircraft-induced sound wave pressure and vibrations'. The consultancy projects in hand are: Studies on the cause of distress of a 10 million litres capacity CWR and its rehabilitation methodology; Investigations on fire-damaged building at Narora Atomic Power Station; Distress studies for the Indira Gandhi Stadium complex; Design of Kushak Nallah from Sar-

dar Patel Marg to Satya Marg; and Long-term performance monitoring through instrumentation of ring beam and top dome of Kaiga.

Tall Structures

The Centre carries out computer-aided analysis of high-rise buildings with a thrust on development of specific purpose computer software including packages for 2-D and 3-D analyses of tall-framed structures, evaluating effects such as presence of infills, rigid diaphragm action of floor slabs and soil-structure interaction. As a result of these efforts, the Centre has built up a large repertory of software for the analysis and design of such framed structures. Special emphasis is being placed on the preparation of menu-driven user-friendly expert systems providing for specialized add-ons such as facility for optimum design.

Capabilities existing in the area include: Analysis of large building systems such as 2-D and 3-D frames with infills with or without openings using economical algorithms; Analysis of buildings considering asymmetry, with arbitrary configuration of columns and shear walls, non-prismatic beams, etc.; Expert system for automated analysis and design of R.C. framed buildings with



Industrial wind tunnel facility, and 256 channel pressure scanner for wind tunnel testing

detailing and drafting facilities; Optimum design of multistoreyed buildings; and Expert system for industrial structures.

The current in-house R&D projects are: Development of interactive optimal design and drafting expert system for multistoreyed buildings; Development of knowledge-based expert system for industrial structures; and Assessment of fire-damaged structures and their rehabilitation. A consultancy project, 'Investigations on fire damaged building at Narora Atomic Power Station, Narora', is also underway.

Wind Engineering

Working on a wide range of problems associated with wind phenomena and their micro-level effects on structures, the Centre has acquired considerable expertise in analytical studies of wind effects and wind tunnel studies on tower-type structures like chimneys, cooling towers, lattice towers, low- and high-rise buildings and bridges, under simulated atmospheric boundary layer. A boundary layer wind tunnel for studying the aerodynamic behaviour of structures is already in operation. The Centre has developed a number of graphic and interactive software packages for the assessment of wind loads on buildings, chimneys, cooling towers, lattice structures, etc., incorporating the latest IS code provisions.

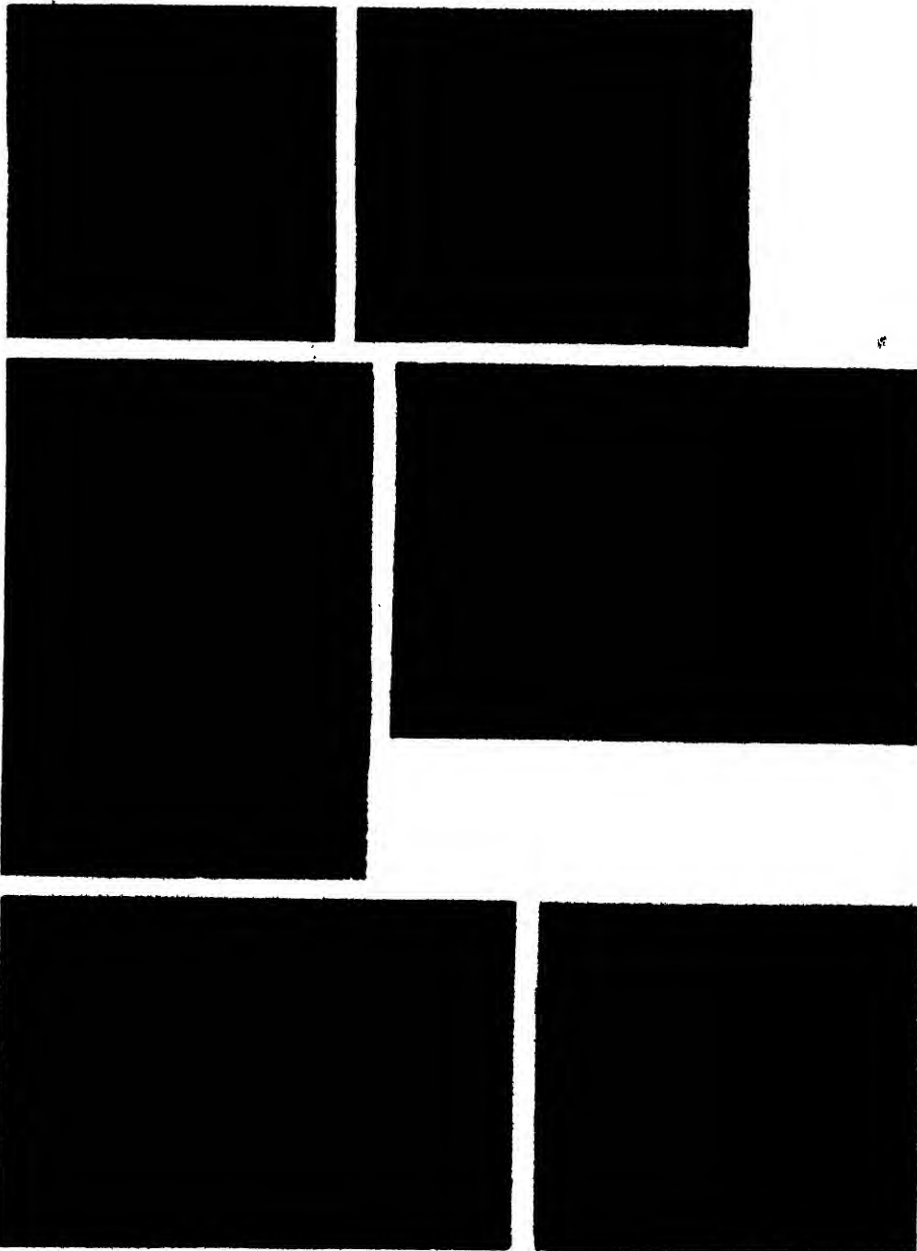
The capabilities attained in the area of Wind Engineering relate to:

1. Structural analysis and design— Development of analytical tools to study the aerodynamic behaviour of tall structures and bridges (including cable stayed bridges); Analysis, design and proof checking of tower type structures like microwave towers, guyed masts, chimneys, cooling towers, etc.; **2. Wind tunnel investigations** — Model studies on tall

structures and bridges in wind tunnel under smooth and turbulent flow; **3. Field investigations**— Field measurement regarding response of tall structures and bridges due to wind.

The software developed include: **RCCHIM** — Interactive soft-

ware for assessment of design loads on RC chimneys as per IS:875 (Part-3)-1987, IS:4998 (Part-I)-1992 & IS:1893-1975; **CTOWER** — Interactive software for the assessment of wind/seismic loads on NDCTS as per IS:875 (Part-3)-1987, IS:11504-1985, IS:1893-1975; **WIND LDR** —



Top : Wind tunnel testing of cooling towers

Middle : Wind tunnel investigations on isolated proposed 190 m chimney

Above : 190m chimney upstream (left) and Set-up for wind tunnel data reduction

Graphic software for the assessment of wind loads on buildings/structures based on IS:875 (Part I-1987).

The current in-house R&D projects relate to: Wind load assessment and wind-resistant design of bridges; Wind loading and response of tower type structures; Interference studies on the group of chimneys and cooling towers; Studies on dynamic response of tall structures due to strong winds; Application of dynamic stall studies concept for predicting aerodynamic flutter de-

rivatives of cable-supported bridges and decks; and Technology for the development of industrial wind tunnel. The sponsored projects underway are: 'Interference studies on the grouping of chimneys and cooling towers for the Panandhrao, Gandhinagar and Wanakbori thermal plants', 'Proof-checking of design of lattice towers and guyed masts', and 'Rational design specification for country's bridges including guidelines for the cable-stayed bridges'.

□

International Symposium on Plant Molecular Biology

AN International Symposium on Plant Molecular Biology was held at the National Botanical Research Institute (NBRI), Lucknow, during 27 December 1997-1 January 1998. Dr R.A. Mashelkar, Director General, CSIR, inaugurated the symposium and Dr Nityanand, ex-Director, Central Drug Research Institute, Lucknow, presided over the inaugural func-

tion. The symposium coincided with the felicitation to the outgoing Director of the institute, Dr P.V. Sane, who relinquished his office on 31 December 1997. Over 25 delegates from various countries, viz. USA, Germany, France, Israel, Japan, Australia, Belgium and Switzerland and 60 delegates from India participated in the symposium. The symposium had five sessions, each

related to different ways of crop improvement through Genetic Engineering.

Welcoming the delegates and the guests, Convener of the Symposium, Dr Pravendra Nath, gave an introduction to the symposium theme 'Crop Improvement Through Gene Transfer: Vision 21st Century'.

In his address, Dr Mashelkar appreciated the effort of NBRJ for pioneering the Plant Molecular Biology research in the country and commended the orientation of the scientists towards applied research. He lauded the effort of Dr P.V. Sane for establishing the Plant Molecular Biology research in NBRI and creating the Centre for Plant Molecular Biology (CPMB) with grant-in-aid support from the Department of Biotechnology, Government of India. The function was also addressed by Dr Sane who gave a brief account of the history of CPMB and its continued growth in terms of facilities, manpower, knowledge generation, publications and patents. Dr Nityanand stressed the need of applied research in today's scenario while Dr B.P. Singh, Chairman, Organizing Committee, thanked the delegates for gracing the occasion.

The scientific sessions began from 28 December. The first session included deliberations on chloroplast genome organization, with P. Westhoff (Germany), K. Kowalik (Germany), P. Chitnis (USA), S. Kapoor (Japan), Pal Maliga (USA), Akhilesh Tyagi (India), J. Khurana (India) and A.N. Lahirimajumdar (India) being the notable speakers. Various technologies and theories were discussed for the improvement of photosynthetic capacities of chloroplast and how chloroplast could be utilized for more than one way for beneficial purposes.

The second session related to molecular basis of cytoplasmic male



Dr R.A. Mashelkar delivering his inaugural address at the 'International Symposium on Plant Molecular Biology'. Sitting on dais (from left) are: Dr P. Nath, Dr P.V. Sane, Dr Nityanand and Dr B.P. Singh

sterility in plants and the mitochondrial genome. The session included talks delivered by J.H. Weil (France), Shamay Izhar (Israel), P. Bhalla (Australia), K.K. Narayanan (India) and H.S. Gupta (India). The role of mitochondrial genome in cytoplasmic male sterility in plants was the major focus of attention. The male sterile plants are used in hybrid seed production. Also discussed was the generation of male sterile plants, using tools of genetic engineering.

The third session comprised presentations on development of insect pest resistant transgenic crop plants. Marc Van Montagu (Belgium), Nalini Desai (USA), Neal Stewart (USA), Gunther Hehne (Germany), Nazir Mir (USA), and D.V. Amla (Lucknow) were the main speakers. Various strategies for using endotoxin gene from *Bacillus thuringiensis* and its implication and how damage from fungal toxin can be controlled were the major topics for discussion.

The fourth session was on plant viral genome and disease-resistant transgenic plants. Addresses were delivered by Bruno Gronenborn (France), R.M. Leiser (Germany), A. Iglesias (Switzerland), Anupam Verma (New Delhi), B.P. Singh (Lucknow). Use of viral genomic sequences for raising disease-resistant transgenic crop plants and other useful purposes was discussed in details.

The fifth and the last session was related to the molecular biology of fruit ripening and ethylene signal transduction. Autar Mattoo (USA), H. Imaseki (Japan), J.C. Pech (France), M. Bouzayen (France), M. Tucker (USA) and Avi Sadka (Israel) deliberated on how the ripening process in various fruits can be slowed down by using antisense technology. The signal transduction pathway of plant hormone ethylene which initiates various processes in

plant was discussed. Also discussed were the various processes for making citrus fruits more juicy and sweet and protecting them from quick spoilage.

The valedictory session on the evening of 1 January 1998 witnessed the presentation of a detailed report of the symposium outcome by Dr P. Nath, recommendations by session Chairpersons Peter Westhoff, J.H. Weil and Autar Mattoo, and observations by Dr P.V. Sane. Dr B.P. Singh proposed a vote of thanks.

While giving details of the various observations made at the symposium, Dr P. Nath invited expert scientists from India and abroad to collaborate with scientists of NBRI in academic areas of mutual interests.

Prof. Peter Westhoff, Dusseldorf, Germany, was impressed by the quality of science being done in India, particularly at NBRI, in the area of Plant Molecular Biology. He found a lot of promise and hope among the young scientists and research students of the institute and felt that there should be greater exchange of thoughts and personnel between India and other countries.

Prof. J.H. Weil, Strasbourg, France, opined that such meetings should be arranged more often. He congratulated the organizers for success of the symposium and attributed the success to the smaller size of the meeting, which gave lot of time and scope for interaction. Appreciating the high quality of symposium lectures and abstracts, Prof. Weil promised all help for the betterment of science at NBRI. He also expressed that the motto of the symposium 'Interactions bring collaborations' was achieved to a good extent.

Dr Autar Mattoo, USDA, USA, also expressed happiness over the success of the meeting. He empha-

sized that being Indian by birth and training, he was aware of the problems being faced by Indians. He called upon scientists, particularly graduate students, to put more efforts in research which is more applicable and would help solve the food problem in India. He opined that instead of deep basic research problem they should look for a problem the solution of which would provide a better quality of food to the consumer. He observed that though there are many more poor people in India, the life style of Indian upper middle class is changing very fast. They have money and want to spend it on a better quality food. So why not to cater to their needs and build a better economy of the country. He added, "you can always borrow technology from the west but utilize it in your own perspective. You do not have to look towards the west for all your needs that you can meet right here."

Dr P.V. Sane stressed the need for greater interaction between the younger scientists, particularly young researcher and rest of the country. In this context, he appreciated the efforts of the organizers in bringing the experts from outside and providing an opportunity to the young researchers to interact with them personally.

Dr B.P. Singh while proposing the vote of thanks hoped that linkages developed in this meeting between the NBRI scientists and scientists from abroad and other parts of the country will go a long way in advancing the discipline of Plant Molecular Biology. □

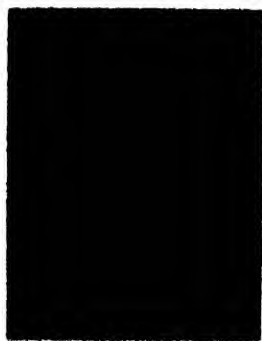
Dr S.M. Sarin appointed Acting Director of CRRI

DR S.M. Sarin, Seniormost Deputy Director & Head, Environment and Road Traffic Safety Division, Central Road Research Institute (CRRI), New Delhi, assumed charge as Acting Director of the institute with effect from 6 November 1997, following the sad demise of Prof. A.K. Gupta, the then Director [CSIR News, 47 (1997), 351].

Dr Sarin's main area of specialization is traffic and transportation planning including road safety and environmental issues. □

Dr M. Raghavan appointed Acting Director of CECRI

DR M. Raghavan, Deputy Director, Central Electrochemical Research Institute (CECRI), Karaikudi, assumed charge as Acting Director of the institute with effect from 17 November 1997.



Dr Raghavan holds an M.E. degree from IISc, Bangalore and Ph.D. degree from the Madurai Kamaraj University. His areas of interest include: Battery-operated electric vehicles and batteries for these vehi-

cles, Electroforming and heavy electrodeposition (electroforming of thrust chambers for cryogenic rocket engines for LPSC, ISRO, constituted a prestigious project of the institute), Solar thermal energy utilization, Design and fabrication of chemical engineering equipment and Corrosion prevention and development of corrosion inhibitors. He has been a member of the teams for several R&D projects (in-house as well as sponsored/consultancy) in the above areas. Has published over 40 research papers and presented 30 research papers/invited lectures. □

HONOURS & AWARDS

Dr D.C. Mishra

DR D.C. Mishra, Scientist F, National Geophysical Research Institute (NGRI), Hyderabad, has been awarded the '1996 National Mineral Award' by



Ministry of Mines, Government of India. He received the award under the category 'Geophysics' for his significant contributions towards application of geophysical methods to crustal studies, tectonics and geomagnetism, exploration and geodynamics.

Dr Mishra is responsible for planning, execution and monitoring

of gravity and magnetic surveys, processing and modelling of these data sets and their integration with other available geophysical data in Peninsular India. Based on modelling of large wavelength gravity and magnetic anomalies (Satellite and Airborne), he has provided information on density and susceptibility inhomogeneities in the crust and Curie point geotherm map for most of the geological provinces of the country, including the seismically active regions around Latur and Koyna. He has modelled the gravity-magnetic data from the west and east coasts of India, Arabian Sea, Bay of Bengal, Antarctica and Himalayas to understand the break-up and drift history of the Indian plate.

Dr Mishra did his M.Sc. (Geophysics) from the Banaras Hindu University (BHU) and served as lecturer in the Department of Geophysics, BHU, during 1965-66. After completing his Ph.D. (Geophysics) from BHU and Tata Institute of Fundamental Research, Mumbai, he joined NGRI, first as Post Doctoral Fellow (PDF) of CSIR in 1966 and subsequently, as Scientist B in 1968. For a brief stint, he was a Post Doctoral Fellow and European Commission Fellow in Germany and Denmark. □

NAL - UNI Lecture Series rescheduled

The course on 'Software Engineering for Mission/Safety — Critical Systems' scheduled for 17-19 December 1997 (CSIR News, 47 (1997), 336) under the title series will now be held on 18-20 March 1998. Further details can be had from: The Head, Technical Secretariat, NAL, Post Bag No 1779, Bangalore 560017. □

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CSIR NEWS

RRL-Bhopal develops Transparent Draft Tube Cone for BHEL's Model Hydroturbine

BHARAT Heavy Electricals Ltd (BHEL), Bhopal, manufactures hydroturbines of various capacities. These hydroturbines are used to generate electricity by converting kinetic energy of water into mechanical energy which in turn is used for production of electricity. A vertical hydroturbine essentially consists of a runner and draft tube in addition to various other components. Runners are designed to utilize kinetic energy of water into rotational motion. Draft tube provides outlet to water flow through runners as well as helps in recouping a portion of kinetic energy at the outlet of runner, thereby increasing efficiency of the turbine. In hydroturbine model, this portion is made up of transparent material to view runner outlet through this draft tube cone (D.T. cone). Initiation of cavitation and its progress is observed in the form of air bubble/separation cavities at the outlet of runner as well as in the draft tube. These phenomena have to be photographed to study the performance of runner and runner profiles in hydraulic turbines. Therefore, transparency of D.T. cone assumes paramount im-

portance. It should as well possess adequate strength to withstand high water pressures.

Presently, BHEL is using imported D.T. cones which cost over

Rs 100,000 each depending upon their sizes. Size of D.T. cone varies with the capacity and design of hydroturbine. BHEL uses D.T. cone of the following dimensions — Height:



Transparent Draft Tube Cone produced using the indigenous process developed jointly by RRL-Bhopal, and BHEL, Bhopal. Used in hydroturbines, these D.T. cones are presently imported from Japan and Russia

240-600 mm, Diameter : 350-680 mm, Thickness : 20-40 mm.

These cones are being imported from Japan and Russia. Japanese cone is made of several concentric rings which are joined together to form the integrated cone. Russian cones are made by bending and joining of acrylic sheet to the desired shape. As an alternative, BHEL adopts the latter process, i.e. the cones are made by joining techniques. But the joints not only hinder the observation but also cause water leakages at time.

To overcome this problem, a research project was sponsored by BHEL to Regional Research Laboratory (RRL), Bhopal. The aim of this project was to develop a seamless casting of acrylic polymer.

Main problem associated with the large size casting of acrylic monomer lies in the exothermic reaction which produces 13 kcal/mol of the monomer during polymerization. Removal of heat energy to maintain a constant temperature becomes important to control the reaction rate. Owing to excessive energy in the system, temperature of monomer increases and vaporizes the monomer. Vapour is converted into bubbles. This produces a defective casting. Acceleration of polymerization rate of methylmethacrylate (MMA) also increases with the syrup viscosity. Thus an auto acceleration is noticed even when the temperature is constant. Under such circumstances, it is extremely difficult to produce an item by MMA which has a thickness of over 20 mm. Draft tube cone being 40 mm thick, casting is a difficult task, and therefore imported cones as well as

indigenously produced cones are made by bending and joining techniques.

RRL and BHEL, Bhopal have now jointly developed the process of making items of large thickness such as D.T. cone. This is a unique process development, which has

opened up new areas of application, particularly where transparency, thickness, toughness, machinability, and durability are required. The process has been demonstrated at BHEL and a full-size cone has been developed for its model hydroturbine. □

Reverse Osmosis Sewage Water Treatment Plant Commissioned at MRL, Chennai

A reverse osmosis pilot plant to treat sewage water has been installed at Madras Refineries Ltd (MRL) at Manali-Chennai by the Central Salt & Marine Chemicals Research Institute (CSMCRI), Bhavnagar. The plant is designed to produce 40,000 litres/day of processed water from sewage water. The pilot plant consists of filtration system, high pressure pump, pressure vessels, and thin film composite membrane spiral elements (developed by CSMCRI) and the control panels. The control

panels include conductivity meters, pH meters, flow meters, pressure gauges, temperature scanner, etc. for continuous on-line monitoring of various parameters.

A prototype reverse osmosis unit was operated at MRL with the new generation membrane (thin-film composite - TFC) indigenously produced at CSMCRI, during the last three years. Based on satisfactory and consistent performance of TFC membrane, the present pilot plant has been designed and commis-



Dr R.A. Mashelkar visiting the reverse osmosis pilot plant installed by CSMCRI at MRL, Manali-Chennai

sioned to generate field data which will be useful for designing a large-scale commercial plant. This project is partially funded by the Department of Science and Technology, and MRL is actively participating to assess performance of the indigenous membrane.

The pilot plant was commissioned on 15 January 1998 at MRL, Manali-Chennai. Dr R.A. Mashelkar, Director General CSIR, visited the plant on 3 February. □

CMRI signs MoU with Wavelet Group, Pune

A memorandum of understanding has been signed in the recent past between the Central Mining Research Institute (CMRI), Dhanbad, and Wavelet Group, Pune, in connection with the development of FRAGALYSIS system.

This system would be useful for computer-aided fragmentation

analysis of any muck pile, drill cutting, etc., and joint plotting, block size determination in respect of rock masses in the *in situ* conditions.

CMRI would provide intellectual input for the development of the system and Wavelet would be responsible for its manufacture and marketing. □

REGIONAL RESEARCH LABORATORY, THIRUVANANTHAPURAM R & D Highlights: 1996-97

THE Regional Research Laboratory (RRL), Thiruvananthapuram, pursues its R&D activities in the following areas; Post-harvest processing of oilpalm and coconut; Spices processing & flavour technology, Organic chemistry and natural products; Biotechnology, bioprocessing and biomolecular research; Speciality polymers; Beneficiation of ilmenite; Clays & clay minerals; Structural ceramics; Electronic ceramics; Alloys & composites; Computational material science; Inorganic & analytical chemistry; Photochemistry; and Wastewater technology. A Centre for Marine Analytical Reference and Standards (C-MARS) is also functioning at the laboratory, as a DOD project.

During 1996-97, the laboratory had a total of 50 projects in hand, of which 46 were externally-funded and four were in-house. Fifteen new projects were undertaken. A special mention may be made of the MoU signed with M/s A.P. Oil Federation, for establishing 10 tonne FFB/h palm oil mill at a cost of Rs 116 million on turn-key basis, at

Ashwaraopet in Andhra Pradesh, and pilot plant level demonstration of the process for manufacture of synthetic rutile at Travancore Cochin Chemicals Ltd. Six technologies were assigned to NRDC. In addition, a software, RAGA - Rising and Gating with autocad was licenced to HAL, Bangalore. Nine patent applications were processed/filed. A total of 130 papers, 67 proceedings, and two books were published. Twenty-three articles were contributed in various books.

The laboratory's External Cash Flow during the year amounted to Rs 37.60 million as against its total budget of Rs 45.56 million. It also received a World Bank loan of Rs 4 million.

An account of the major activities/achievements of the laboratory during 1996-97 is presented here:

GLOBALIZATION MEASURES

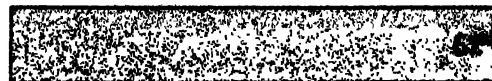
The laboratory has obtained approval for two Scientist Exchange Programmes with Japan for carrying out R&D in the area of solid-acid

catalyst from clay minerals and utilization of clay and ilmenite minerals of Southern India.

An Indo-German collaborative research project on 'alumina silicon carbide nanocomposite' with Technical University of Hamburg, for a period of three years has been initiated.

A joint project with M.G. University, Kottayam and with scientific support from the University of Wurtzburg, Germany, on production of sol-gel high surface area ceramic oxides including aerogels has been initiated as a spin-off of a successfully completed DST grant-in-aid project on pillared smectites for very high surface area ceramics.

A feasibility project for the production of insulin from chicory roots has been completed for M/s Monsanto Group, USA, and the process flow sheet has been supplied to the company.



INDUSTRY & ECONOMY-ORIENTED PROCESSES

Metallurgy

Synthetic Rutile from ilmenite

— A major laboratory programme on the development of an environment-friendly process for the manufacture of synthetic rutile involving pilot plant demonstration and technology transfer has been completed. The pilot plant demonstration trials at the user industry premises, M/s Metallurgical Engineering Consultants Ltd (MECON), India, have conclusively established the economic viability of a 30,000 tonnes/annum plant at a Greenfield site in Kerala.

Commercialization is anticipated during the next few years. With the commissioning of the plant at full capacity, the laboratory will receive a substantial amount as royalty for five years as per the MoU.

Metal Matrix Composites —

The laboratory has developed low-coefficient thermal expansion (CTE ~ 14-18 m/°C) composite by incorporating 20-30 vol% milled pitch base carbon fibre in Al alloy matrix by stir casting technique. This material will be useful for critical applications in the area of MMC.

Materials

Clays — Impregnation of metal halides into natural kaolinitic clays led to imparting of catalytic activity to an otherwise inactive kaolinitic clay. The catalytic efficiency of the support reagents when employed in the benzylation of benzene was found to be in the order $\text{FeCl}_3 > \text{ZnCl}_3 > \text{MnCl}_3 > \text{SnCl}_3 > \text{AlCl}_3$. One gramme of supported FeCl_3 catalyst (1 mmol/g of clay) gave

86% conversion to diphenyl methane with 100% selectivity at reflux conditions. Twenty-five catalysts were prepared with varying Bronsted and Lewis acidity and their activity monitored with a hexene-hexene mixture at 180°C and autogenous pressure in a Parr reactor system. Their performance compared with a commercially available catalyst. The temperature-programmed absorption-desorption phenomena of these catalysts, studied employing FTIR technique using pyridine as probe molecule revealed that organic acids contribute to more Lewis sites on clays compared to their mineral acid treated counterparts.

Studies were made on the effect of micronization on the crystalline structure of kaolinite and its influence on adsorption/ion exchange properties of heavy metals. It was found that grinding in a ball mill is a slow process compared to oscillatory milling which causes delamination followed by amorphization of kaolinite. Adsorption kinetics of Cd, Cu, Zn and Ni improve slightly during the initial stages of grinding as a result of delamination, after which these decrease due to agglomeration of particles as evidenced from particle size, surface area, thermal and SEM analysis.

Techno-economic pre-investment feasibility report on production of kaolin from sandy clay deposits occurring in Sawa (Rajasthan) has been prepared for M/s Sawa Clays, Rajasthan, under a consultancy assignment.

Ceramics — The laboratory process development of alumina ceramics programme sponsored by M/s Carborundum Universal Ltd has been completed. The demonstration of the process followed by scale-up

as well as commercialization are planned.

A pilot plant/demonstration facility for tannery sludge-clay bricks at Chennai has been finalized in collaboration with M/s Southern Bricks Works Ltd (KKR Group of Companies) and Central Leather Research Institute, Chennai, with possible funding from TIFAC, Government of India. This programme will have technical support from The Netherlands Institute of Applied Research, which was one of the collaborators in the development of this project earlier.

A technological mission has been launched jointly by the laboratory and TNO experts along with M/s Calcutta Electric Supply Co., Calcutta, to study the feasibility of the process of flux-bonded fly ash developed at the laboratory level. The process details will be modified to suit the feasibility study for future transfer to industry.

Polymers — A cost-effective process has been developed for the preparation of cardanyl acrylate (CA). The monomer was prepared at 1 kg level and polymerized to get polycardanyl acrylate (PCA). The properties of the polymer with regard to its curability for surface coating applications were evaluated with respect to its molecular weight, and the required molecular weight for getting effective curing behaviour determined. PCA alone on curing gave water-like transparent films and showed excellent compatibility with a number of pigments. The kinetics of polymerization by free radical mechanism was also studied. As a first phase of technology transfer, 100 g of PCA has been handed over to the sponsor of the project, M/s Vijayalexmi Cashew Company, Quilon.

Highly crystalline conducting polyaniline has been prepared by doping with the phosphoric acid ester of pentadecyl cardanol. This is the first time that a highly crystalline polyaniline has been reported.

Composition variation study of the formation of liquid crystalline (LC) copolyester between hydroxybenzoic acid (HBA) and 8-(3-hydroxyphenyl) octanoic acid (HPOA) and a bromo derivative of HBA indicated that a 30-40% HPOA content gives an LC copolyester with a nematic texture with the Br-HBA copolyester at a higher transition temperature. Ternary LC polyesters prepared from terephthalic acid, hydroquinone and 4-hydroxyphenyl propionic/acetic acid hydroquinone were further characterized. Compositions containing 30-40% 4-hydroxy phenyl propionic/acetic acid brought down the T_m to 275°C and the copolyesters were nematic LCs with threaded texture. Poly(esteramide)s (PEAs) containing aromatic moieties in the diamide link prepared in the laboratory, exhibited better thermal stability than their counterparts having aliphatic diamide links. The lyotropic behaviour of these polymers, studied using DSC, hot stage light microscopy, viscosity measurements and GPC, exhibited typical concentration-dependant anisotropic phase behaviour for these systems. All phases were nematic.

Agroprocessing

Oil Seeds — The laboratory has taken up a turnkey project for establishing 10 tonne FFB/h palm oil mill for A.P. Oil Federation, at a total cost of Rs 116 million at Ashwaraopet in Khamam district of Andhra Pradesh. This project has the distinction of being considered

by the Technology Development Board of DST as a first project to be given the financial support through soft-loan facility for the promotion of indigenous technology.

A commercial plant for integrated coconut processing based on RRL-T technology to process 20 thousands fresh nuts per day has been commissioned for M/s Fresh Coconut Products at Irinjalakuda, Kerala, at a total cost of Rs 30 million. The product line includes canned coconut cream, instant cream powder, low-fat desiccated coconut powder, food formulations, coco vinegar from coconut water and shell charcoal. This is the first plant of its kind in the country to be set up utilizing an indigenous technology with process and product integration and is financed by KSIDC and ICICI.

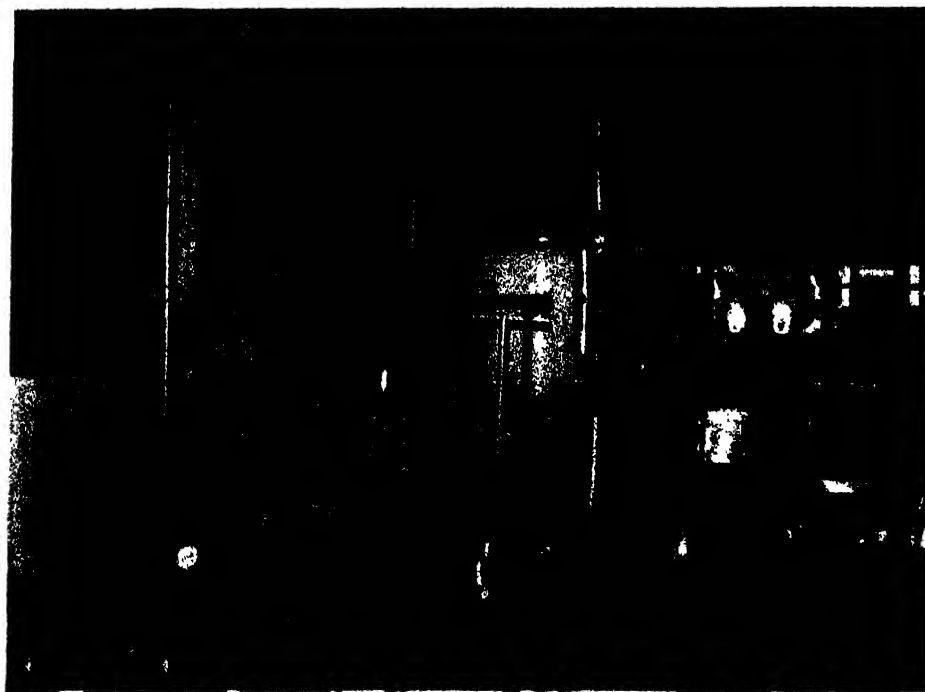
Spices — The facility for technology development and training in agroprocessing for spices under the

joint programme with Department of Agriculture, Government of Kerala, has been made operational and a few trial runs carried out on fresh flavoured ginger oleoresin, steam distillation of spice oils, microencapsulation of flavours and green white pepper products. Based on preliminary trials on the development of fresh flavoured ginger oleoresin, the Ministry of Food Processing Industries, Government of India, has sanctioned Rs 2.8 million for pilot plant scale studies.

SOCIETAL PROGRAMMES

Biotechnology

Studies on production of cyclosporin A (CSA) using *tolypocladium inflatum* B-58 were carried out for further improvement of the process. The laboratory efforts were directed towards a viable and economically feasible fermentation method for the production of CSA.



Commercial coconut cream plant with a capacity of 20,000 fresh nuts/day to produce 5000 kg coconut cream or 2,500 kg cream powder and 1000 kg low fat desiccated powder, commissioned by RRL(T) for M/s Freshco, Irinjalakuda

The impact of various physical and chemical process parameters have been optimized and encouraging results obtained. Medium supplementation with an amino-acid further improved the CSA synthesis by the fungal strain. A whole immobilized bioreactor has been designed to study the biotransformation efficacy of the biocatalyst embodied in various encapsulation agents. Bioreactor operations were monitored in batch and recycling modes.

Spices

Exposure training on value addition and quality aspects of spices was given to the first batch of progressive farmers from Waynad and Idukki districts.

Oil Seeds

A national workshop on 'Red Palm Oil and Health: Perspectives for India' was organized under the sponsorship of TMO&P, Nutrition Society of India, AFST along with RRL-T. The workshop focussed on the future activities in this important area, while endorsing the use of red palm oil at national level, as a dietary solution to Vitamin A deficiency. A training programme for women entrepreneurs at home-scale processing has been launched and training is being imparted to selected entrepreneurs.

Health and environment

Iodine is an essential trace element required for the health of human body. An efficient method based on ion chromatographic separation followed by spectrophotometric measurement, has been developed and successfully applied for determination of iodine in sea water, iodine salt and in urine.

The toxicity of chromium (VI) to biota and the nontoxicity of Cr(III) are well known. The BIS specifica-

tions for effluent discharges into the aquatic environment specify a maximum limit of 0.05 ppm of Cr(VI). The measurement of chromium should therefore discriminate Cr(VI) from Cr(III). A method for this purpose has been proposed based on preferential adsorption of the DDTC Cr(VI) complex, elution and final determination by AAS. This has been applied to the effluent streams of tanneries and planting industries.

Marine sediments can act as records of anthropogenic activity. Using the technique of flow injection analysis, coupled to a Flame Atomic Absorption Spectrometer, a method has been developed for monitoring the changing levels of the toxic elements: cadmium, copper and lead in the marine environment.

A lab scale process has been developed for the removal of colour of molasses from distillery effluents and a patent filed.

The Engineering Block for housing the World Bank project on wastewater technology is operational and pilot plant facilities are being developed.

BASIC RESEARCH

High T_c Superconductors

A new class of complex perovskite oxides, Ba₂REH₁O_{5.5} (RE = La, Pr, Nd, Sm, Gd and Eu) have been synthesized and sintered as single phase materials with high sintered density and stability, by solid state reaction method. The complete powder diffraction data of ten new materials have been sent for inclusion in the JCPDS file. This is in addition to the twenty powder diffraction patterns already accepted by JCPDS file for publication. The new materials have dielectric constant and loss factor values suitable for their use as substrates for microwave application.

YBa₂Cu₃O_{7-δ} thick films deposited on polycrystalline REBa₂TaO₆ (RE = Pr, Nd and Sm) gave T_c(O) = 90K and current density of 104A/cm². These measurements were confirmed by non-resonance absorption studies. Vernuill's apparatus for single crystal growth has been fabricated indigenously and single crystals of Ba₂LaNbO₆ have been grown by flame fusion technique.

Highly oriented (001) YBCO superconducting thin films have been developed on REBa₂LaNbO₆ polycrystalline substrates by pulsed laser ablation. The films have T_c(O) = 92K and critical current density 5x10⁵ A/cm² at 77K on these polycrystalline substrates. A novel approach has been adopted for the deposition of YBCO films on Ba₂LaNbO₆, a new substrate material, by pulsed laser ablation. Ba₂LaNbO₆ has been deposited first as an epitaxial thin film on a single crystal MgO substrate by pulsed laser ablation and a superconducting YBCO film developed *in situ* on epitaxial Ba₂LaNbO₆ gave a T_c(O) = 90K and J_c ~ 5x10⁶ A/cm² at 77K with a transition width of 0.5 K. This is probably one of the highest current density values reported for YBCO film in the literature. The film showed perfect metallic behaviour with the ratio R₃₀₀/R₁₀₀ = 2.98.

Organic Synthesis

A facile electron transfer reaction leading to dimerization and cyclization of methoxy styrenes mediated by cerium (IV) ammonium nitrate (CAN) has been discovered. The process could be useful in the synthesis of certain biologically active natural products.

A novel 1,3-dipolar cyclo-addition of nitrileoxides to *o*-benzoquinones has been developed. Certain fulvenoid compounds have been

shown to undergo novel higher order cyclo-additions.

A facile synthesis of lactones using a novel chiral auxiliary derived from D-glucose has been developed. This process has potential application in the synthesis of certain pheromones. A novel glycosidation procedure utilizing monomorillonite K-10 clay catalyst has also been developed.

Photochemistry

Some of the newly synthesized near-infrared (NIR) absorbing squaraine dyes have been shown to be excellent probes for the selective detection of trace amounts for transition and lanthanide metal ions in aqueous and nonaqueous media. These NIR dyes are also capable of extending the photoresponse of large band gap semiconductors. A new class of squaraine dyes capable of generating singlet oxygen have been synthesized and their photosensitizing properties explored. Pyrrole-derived soluble conducting polysquaraines with narrow band gap have also been synthesized. Use of pyrylium sensitizers for efficient charge separation by generation of some of long lived phenothiazine systems such as substituted dibenzobarrelenes and aziridines were investigated by steady state and laser flash photolysis studies.

A sponsored project (Rs 200,000) from GOMAS Systems and Controls Pvt. Ltd, Bangalore, has been received for the development of time-temperature indicators.

Biomolecular Chemistry

A novel receptor molecule crafted from adamantane unit carrying two bidentate hydrogen-bonding pockets in the form of 2-ami-

nopyridine sub-units has been demonstrated to generate persistently one-dimensional self-assemblies (with 1-alkane dicarboxylic acids, perchlorate ions and Cu^{II} ions) of relevance in the context of designing selective transporters of various types of substrates or as scavengers in purification or detoxification procedures. Hydrogen-bonded, two-dimensional self-assemblies with layer motifs have been delineated in the salts of squaric acid with histidine amino acid and related nitrogen bases. These self assemblies exhibit modest NLO activity.

Poly-cystinyl peptides have been designed for use as novel cross-linking motifs in the study of protein-folding. A minimal zinc-finger motif for DNA study has been designed and characterized. Gramicidine-pore has been modified by selective tryptophan replacement.

Inorganic & Analytical Chemistry

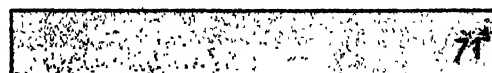
Itinerant-extraction behaviour of Yttrium — The ligand-dependent properties of yttrium have been recently exploited for the preparation of high purity yttrium oxide by liquid-liquid extraction. The anomalous behaviour of yttrium was investigated from aqueous solutions containing soft and hard ligands using octyl(phenyl)-N,N-diisobutylcarbamoylmethyl phosphine oxide (CMPO) as an extractant. Better selectivity among yttrium and especially heavy lanthanides (separation factor, S.F = Lu/Y = 49) was achieved with CMPO as compared to the di-2-ethylhexyl phosphoric acid system (S.F = Lu/Y = 19), which has been widely used in the rare earth industry. Thus, by exploiting the itinerant behaviour of yttrium, a separation scheme has been pro-

posed for the separation of yttrium from heavy rare earths in fewer stages of counter current extraction from xenotime mineral.

Development of luminescence spectrometric procedure for rare earths — A luminescence procedure has been developed for the determination of europium with a detection limit of 0.1 picomolar, by using HTTA-dibenzo-18-crown-6 system, with terbium acting as an activator. The developed procedure has been found to be useful for the determination of traces of europium in high-purity lanthanum, praseodymium and dysprosium oxides.

Computational Material Science

A novel control of chaos technique has been proposed which seems to be better than many such techniques available in the literature. It has also been demonstrated that through control of chaos, particles of different aspect ratios can be separated from a heterogeneous suspension. The difficulties with the diffusion approach to suspension rheology have been highlighted and a brute force technique to calculate the rheological parameters has been developed. Rheological parameters such as the two apparent viscosities and the first and second normal stress difference can be realized. Complex periodic viscosity traces can also be realized. A new type of intermittency has been found in the dynamics of periodically forced spheroids and a new route to chaos involving the simultaneous appearance of period adding the quasi-periodic routes to chaos have been observed in the dynamics of periodically forced slender bodies in simple shear flow. □



Management Development Programme on Operation, Maintenance and Repair of Bio-medical Equipment for Third World Countries

THE fifth international 'Management Development Programme on Operation, Maintenance and Repair of Bio-medical Equipment' for the Third World Countries, conducted by the Central Scientific Instruments Organisation (CSIO), Chandigarh, concluded on 9 December 1997. Attended by 15 international delegates from as many as eight countries, the 8-week programme was sponsored by the Ministry of External Affairs, Government of India, under the ITEC/SCAAP Programme. The countries represented were Syria, Sudan, Tanzania, Lao PDR, Indonesia, Philippines, Senegal and Palestine.

The programme, gave a broad overview of the fairly large spectrum of medical instrumentation used in various specialities of medicine. The schedule included lecture sessions covering basic principles, operation and applications; hands-on sessions involving real life repair and maintenance problems on different types of medical instruments, followed by study tours and visits to medical institutions, state-of-the-art diagnostic facilities and industries.

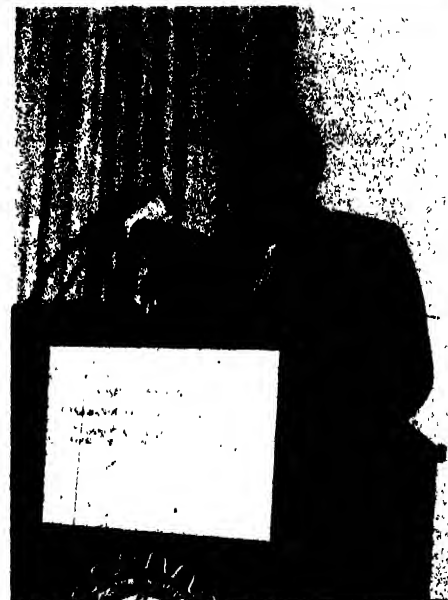
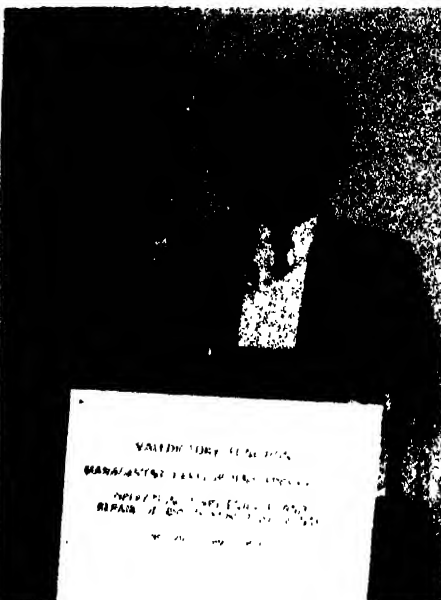
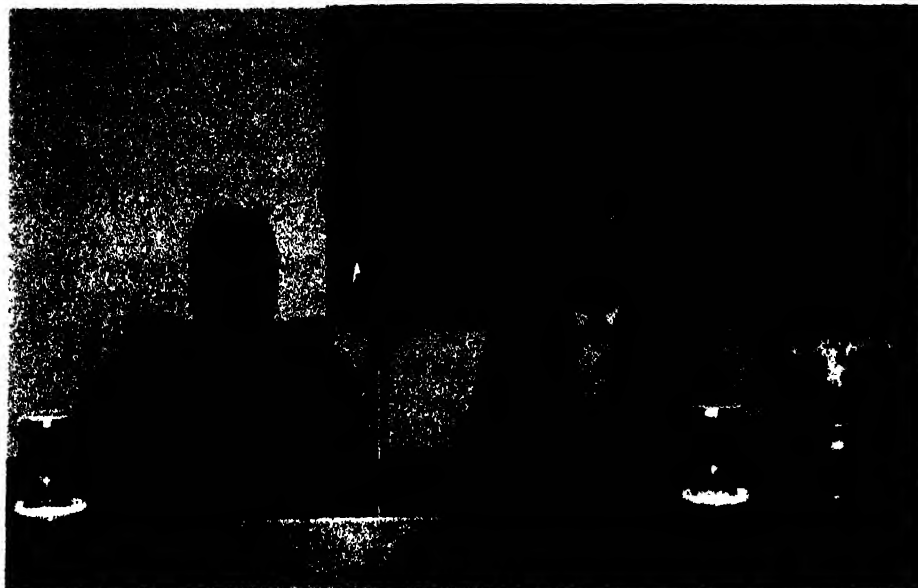
The areas covered during the three-week period that the delegates spent in Chandigarh included: Medical imaging covering X-ray, CT scan, MRI and ultrasound imaging; Instrumentation for neo-natology, Neurology and cardiology; Dental equipment, Ophthalmic and Endoscopic instrumentation, Instrumentation for cancer therapy as also for Nephrology. Lectures were also arranged in the field of ENT, Eye Care instrumentation and safety aspects of medical equipment in hospitals.

The hands-on sessions covered repair and maintenance of equip-

ment such as, Ultrasound scanner, Diathermy machines, Dental equipment, Optical and ophthalmological equipment, ECG machine and ECG simulator, Analytical instruments, Colorimeter, Pulse oximeter, Drug

infusion pump, Centrifuge, Suction pump, Neo-natal equipment including baby incubator.

Visits were arranged to Departments of Anaesthesia, Pathology,



Top : Prof. S. Mohan, Director, CSIO (left) and Shri S.S. Channy, IAS, Managing Director, Punjab Health Systems Corporation & Special Secretary to the Government of Punjab, Department of Health & Family Welfare, at the valedictory function of 'Management Development Programme on Operation, Maintenance and Repair of Bio-Medical Equipment for Third World Countries'.

Above : (left) Shri S.R. Taneja, Senior Dy. Director and Head, EMID, welcoming the Chief Guest; and (right) a participant expressing his views about the programme

ICV, etc. of the Government Medical College, Chandigarh; Departments of Radiodiagnosis, Paediatrics, Cardiology, Ophthalmology, Gastroenterology, Radiotherapy, Dentistry, ENT and Nephrology of PGI, Chandigarh. A visit was also arranged to Body Visions, SAS Nagar, for MRI, and to Recorders & Medicare—manufacturers of Neurological Equipment, Sodhi Clinic, Chandigarh, for X-rays, ultrasound scanners and CT scan and RSIC, Panjab University for demonstration of NMR, electron microscope, mass spectrometer, HPLC, etc.

Prior to this, the delegates spent four weeks in Delhi followed by a study tour to Agra and then a week at Jaipur, wherein the topics covered included lab equipment such as RF diathermy and electro-surgical units, spectrophotometers, basic ultrasonics, and video systems. Sessions were held on test and measuring instruments and calibration, biochemical instrumentation (Bio-sensors), glucometers, blood cell counters, retinoscopes, spectrophotometers, ultrasonic nebulizers, colorimeters, incubators, autoclaves and sterilizers, centrifuges, flame photometers, pH meters, microscopes, electrophoresis, auto analyzer and blood gas analyzer.

In Delhi, study tours were arranged to RML Hospital, NPL, AIMIL, IIT, CSIR Centre for Biochemical Technology, Ranbaxy, BPL, ERTL, Bhushan & Bhushan and Medicare Industries. In Jaipur, they were taken to Santokba Ji Durlabh Ji Memorial Hospital, Soni Hospital, REIL, and to the Artificial Limbs Centre (famous for 'Jaipur Foot').

The management aspects included in the programme were : International guidelines/standards on maintainability, safety and reliability, Maintenance & repair of centres

in hospitals, Maintenance management of health care equipment, Establishing repair and maintenance centres, and Safety aspects in biomedical instrumentation.

The PGI, Chandigarh, which has been collaborating with CSIO in developing state-of-the-art medical instruments, provided substantial amount of help with their faculty in delivering lectures to the international delegates and also allowing them to visit its various departments where contemporary medical equipment are available. The international delegates expressed total satisfaction with the programme.

Valedictory Function

Taking stock of the impact of the five programmes on Bio-medical Equipment organized by CSIO since March 1994, it was observed at the valedictory function that these programmes have enabled the institute win worldwide acclaim. The response from the Third World countries for these programmes has been very encouraging. The Ministry of External Affairs has identified CSIO as a permanent venue for programmes of this nature.

Shri S.S. Channy, IAS, Managing Director, Punjab Health Systems Corporation & Special Secretary to the Government of Punjab, Department of Health & Family Welfare, was the Chief Guest at the valedictory function. In his presidential address he said that such type of programmes bring many people, representing different races and cultures, together. He pointed out that medical equipment worth crores of rupees are lying idle in hospitals for want of repair. Money, resources and infrastructure required for this job are not available. He said that in future we are going to rely upon organizations like CSIO for their help not only in the field of repair and maintenance but also in standardizing making specifications of medical equipment.

Prof. S. Mohan, Director, CSIO, in his address acknowledged the suggestions made by the participants and assured them to provide better training material in future. Earlier, Smt. Mohana Rama Murthy, Head, S & M Division, CSIO and Co-ordinator of the programme, highlighted the objectives of these programmes. □

CIMAP-Industry Interactive Meet

Towards Improvement of Medicinal and Aromatic Plant Materials

AN interactive meet between the Central Institute of Medicinal and Aromatic Plants (CIMAP), Lucknow, and industry representatives was organized on 10 December 1997. It was attended by the representatives of various medicinal and aromatic plants-based industries, some of the eminent scientists of the country, including the

members of CIMAP's Research Council (RC), in addition to scientists of CIMAP. Prof. H.K. Jain, former Director, IARI and Deputy Director General, ISNAR, Hague and Chairman of the RC of CIMAP, presided over the meet.

Welcoming the participants, the CIMAP Director, Dr Sushil Kumar gave a general introduction about





Seen during the CIMAP-Industry Inter-active Meet (from left) are : Shri H.C. Jain, Dr Rajendra Gupta and Dr M.M. Johri (standing), Dr B.N. Dhawan and Dr Sushil Kumar

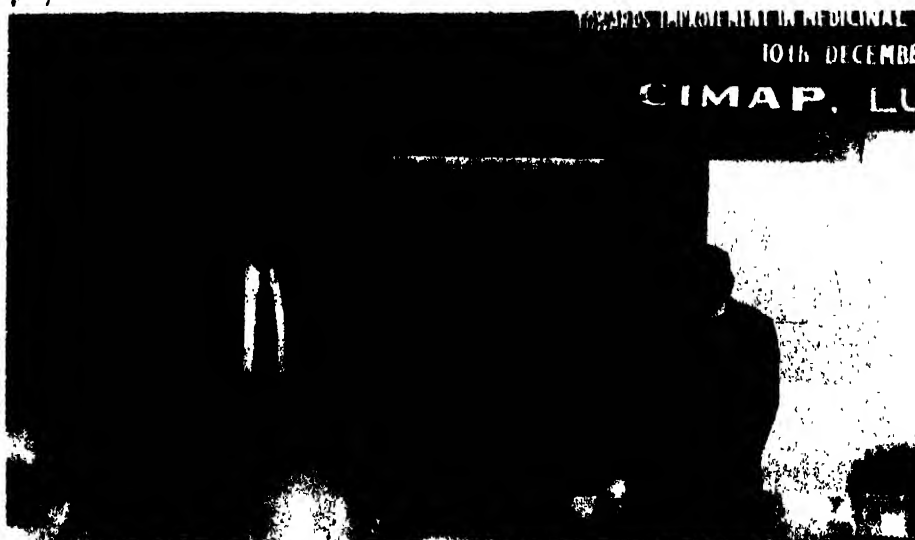
CIMAP's activities including the services offered to the growers, entrepreneurs and industries. Dr R.P. Sharma, Head, Phytochemical Technology Division of CIMAP, spoke about the chemical technologies developed for bioactive phytochemicals, especially taxol and arteether. Dr Y.N. Shukla, Head, Product Development, gave an account of various herbal products and process know-how for isolation of vegetable dyes, developed by CIMAP. These included mosquito repellent lotion and spray, pain balm, anti-crack cream, anti-stress oil, dental powder, among others. Shri A. Naqvi and Dr M.M. Gupta discussed the capabilities of CIMAP regarding quick and accurate analytical methods for quality control. Dr J.R. Sharma, Head, Plant Breeding Division, presented the salient features of the improved plant varieties developed over the years by CIMAP. Dr D.V. Singh, Head, Soil Science and Water Technology Division, discussed the innovations made by CIMAP in agronomic practices for cost saving.

Dr B.N. Dhawan, former Director, Central Drug Research Institute (CDRI), Lucknow, spoke about the

strategies for biological evaluation of medicinal plants. Dr Rajendra Gupta, Member, CIMAP- RC, in his lecture threw light on the landmarks in cultivation and post-harvest processing of medicinal and aromatic plants. Dr Baba Brindavanam of Dabur Research Foundation, Sahibabad (U.P.), discussed the unit operations and storage related aspects for herbal products. Dr M.K. Raina, Technical Adviser, Uttam Pharma Private Limited, Mumbai and Member, RC, CIMAP, talked about physico-chemical tests as means of

standardization of medicinal plants material. Shri G.S. Raju, Chairman of SIRIS Group of Industries, Vijaywada, presented a brief account of current Indian market scenario and future projections on plant-based drugs, herbal preparations, phytochemicals, essential oils, aroma chemicals and fragrances. Each talk elicited considerable discussion.

In his concluding remarks, Prof. H.K. Jain appreciated the efforts of CIMAP in organizing the one-day interactive meet between scientists and representatives of industries. This, he said, has provided an excellent opportunity to CIMAP for strengthening its linkage with the users of medicinal and aromatic plants - related technologies. He added that such interactive meets should be organized on regular basis with more structured discussion on the vital issues related to development and transfer of medicinal and aromatic plants-related technologies. Recognizing the importance of cultivation of medicinal and aromatic plants vis-a-vis increasing global demand of the herbal products, Prof. Jain coined a new term 'mediciculture' for promoting the cultivation of these plants instead of collecting them from wild sources. □



Dr B.N. Dhawan (left) and Prof. H.K. Jain addressing the CIMAP- Industry Interactive Meet

CECRI-Industry Get-together at Cochin

AS part of its Golden Jubilee Year (1997-98) celebrations, the Central Electrochemical Research Institute (CECRI), Karaikudi, organized a CECRI-Industry Get-together, in collaboration with CECRI Cochin Unit, at the International Hotel, Ernakulam, on 15 - 16 December 1997. About 105 delegates representing large, medium and small industries participated in the get-together, the main aim of which was to make the industries in Kerala and new entrepreneurs from the State, aware of the S&T outputs from the institute and its extension centres. Prof. V.N. Rajasekharan Pillai, Vice Chancellor, Mahatma Gandhi University, inaugurated and Dr M. Raghavan, Acting Director, CECRI, chaired the inaugural session. Shri K. Vijayachandran, Chairman, Kerala State Industrial Development Corporation, Thiruvananthapuram and Adviser to the Industries Minister, Government of Kerala, released a souvenir brought out on the occasion. Shri N.S. Narayanan, Executive

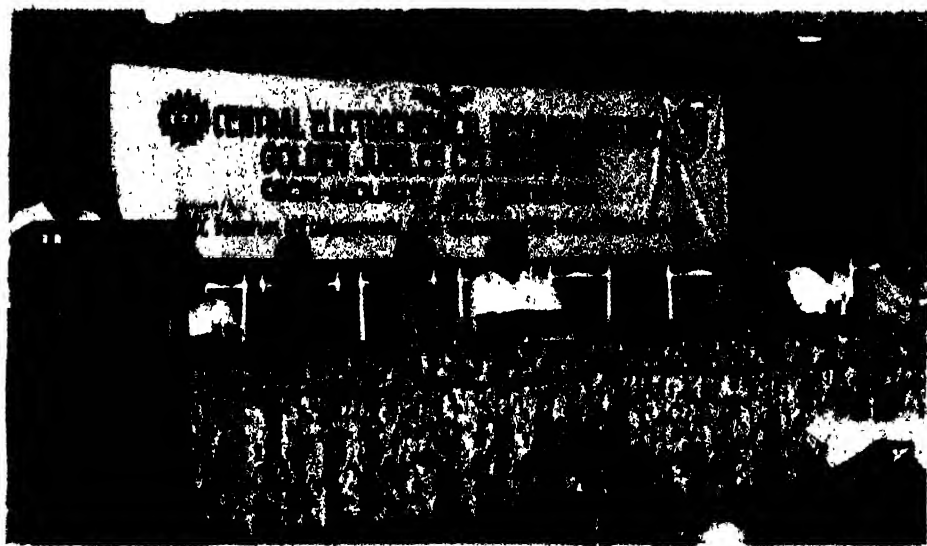
Director, Indian Rare Earths Ltd, Udyogamandal, declared open an exhibition displaying the CECRI R&D activities. Dr K.S. Udupa, Chief Executive, Decor Coatings, Kalamassery, offered felicitations. Dr P.N.N. Namboodiri, Scientist-in-charge, CECRI Cochin Unit, welcomed the gathering. Shri B. Sathianandham, Head, SILEU, CECRI, introduced the delegates to the audience. Shri K.V. Prasad, Scientist, CECRI Cochin Unit, proposed a vote of thanks.

The inaugural function was followed by technical sessions. The first two sessions, viz. Industrial Metal Finishing and Pollution Control and Corrosion Science and Engineering were chaired by Shri P.F. Anto, Dy. General Manager, ONGC, Mumbai. Shri S. John, Shri R. Venkatachalam and Dr (Smt.) Shoba Jayakrishnan, made presentations on technologies developed at CECRI, Karaikudi. Shri John, in his presentation highlighted the achievements of CECRI in the development of cryogenic engine thrust

chamber. GSLV can now be launched by ISRO, using CECRI technology. This will save the country more than 800 millions in foreign exchange. Dr R. Vijayavalli, Deputy Director & Co-ordinator, CECRI Cochin Unit, in her presentation stressed the importance of electrochemical pollution control, especially of the effluents from the electroplating industry, dye-house effluents; etc.

In the section on Corrosion Science and Engineering, Dr N.S. Rengaswamy, Head, Corrosion Division, stressed the importance of corrosion and its control in industries. On a conservative estimate, 2% of the GNP of our country is shown as cost of corrosion. This works out to Rs 170,000 million for the year 1993-94. He stressed the importance of corrosion auditing in industries. Also, he announced that National Corrosion Council of India in collaboration with various organizations embarked on updating the Corrosion Map of India and the work has already been started in Cochin. Dr Palaniswamy and Dr Jayakrishnan, Scientists of CECRI, made presentations on the expertise available at Corrosion Division of CECRI. They stressed the importance of cathodic protection and the development of various paint formulations, for arresting corrosion in different sectors.

The third session was on Batteries. It was chaired by Shri R. Natarajan, General Manager (Mfg), TCM Ltd, Kalamassery, Dr N. Muniyandi and Shri M. Devasahayam spoke about the various battery technologies developed at CECRI. Shri Devasahayam highlighted the expertise of CECRI in maintenance-free lead acid batteries, batteries for vehicles, etc. Dr Muniyandi spoke about the capabilities of CECRI in the development of miniature batteries like lithium batteries.



Dr M. Raghavan, Acting Director, CECRI, delivering his presidential address at the CECRI-Industry Get-together



Dr C. Radhakrishnan, Senior Manager, Binani Zinc Ltd, Binanipuram, chaired the fourth session which was on Metallurgy. Dr Utpal Sen, Head, Pyrometallurgy Division of CECRI, talked about the expertise of CECRI in titanium metallurgy. Dr Venkateswaran, Head, Hydrometallurgy Division of CECRI gave a presentation on the expertise of CECRI in Hydrometallurgy, and the technology for the extraction of gallium, chromium, nickel, etc. developed by CECRI.

On 16 December, the first session on Electrochemicals was chaired by Shri P. Srinivasan, Chief Manager, HOC, Ambalamugal. He gave a key-note address on the current scenario on electrochemical industries in the country and the problems faced by them. Dr V. Krishnan, Head, Electrochemicals Division of CECRI and Dr P. Subbiah, Scientist, CECRI, stressed the advantages of the preparation of chemicals through electrochemical route, environment-friendly nature of electrochemical technologies, etc.

The second session was on Materials Science and Electrochemical Instrumentation. Shri P. Srinivasan, chaired the session. Dr (Smt) Mary Juliana Chockalingam, Head, Electrochemical Materials Science, highlighted the achievements of CECRI in this area and presented various technologies available at CECRI, particularly those related to photoconductive cells, various phosphors, conducting polymers, etc. Shri Y. Mahadeva Iyer, Head, Electrochemical Instrumentation Division, highlighted the capability of his Division in fabricating different electronic instruments for monitoring the electrochemical processes. He particularly focussed on the installation of SCADA at various centres for online monitoring of

corrosion. Dr P. Radhakrishnamurthy, Head, Electrochemical Sensors, in his presentation, highlighted the development of various sensors for monitoring the various pollutants.

In the third session, the expertise available at various extension centres of CECRI were presented. Shri T.S. Viswanathan, Dy. Manager, IRE, presided. Shri K. Dakshinamurthy, Scientist, CECRI Madras Unit, in his presentation explained various aspects of the computerized Battery Testing Centre at CECRI Madras Unit. Dr P.N.N. Namboodiri, Scientist-in-charge, CECRI Cochin Unit, presented the expertise available at his Unit. He said that the CECRI Cochin Unit is running a 500 amp cell for the preparation of high-purity calcium, under a project sponsored by BRNS/DAE. Also, the Unit is undertaking calibration of electrical meters and thermometers. Work has been started on Corrosion Map of India. Dr G. Subramanian, Scientist-in-Charge, CECRI Mandapam Unit, presented the corrosion testing activities at the Unit. Dr A. Rajandran presented the activities of CECRI Tuticorin Unit, covering the aspects such as corrosion owing to bio-fouling, bacterial corrosion and marine electrochemistry.

A panel discussion chaired by Dr V. Krishnan, Dy. Director, CECRI, followed the technical session. Shri K.P.R. Pillai, Consultant, Travancore Rayons, Shri George Jacob from KSIDC, Dr C. Radhakrishnan from Binani Zinc Ltd, participated. Dr Krishnan stressed the importance of interaction among the R&D laboratory, industry and academic institutions. He also summarised the two days proceedings. The get-together was concluded with a vote of thanks by Dr P.N.N. Namboodiri, SIC, CECRI Cochin Unit.

A press conference was also arranged during the get-together (15 December). Dr M. Raghavan, Acting Director, CECRI, Dr V. Krishnan and Shri Y. Mahadeva Iyer, Deputy Directors addressed the media personnel. Dr Raghavan explained the various achievements of CECRI, e.g. development of cryogenic engine, membrane cell technology, corrosion prevention technique, etc. □

CFRI observes Customers' Day

THE Central Fuel Research Institute (CFRI), Dhanbad, celebrated 17 November 1997 as "Customers' Day", with a view to have a better interaction with the customers of the Institute for improving the professional relationship and for formulating the market plan.

During the course of interaction, the representatives of Geological Survey of India, Central Mine Planning and Design Institute (CMPDIL), R&D Centre of Indian Oil Corporation, Dhampur Sugar Mills Ltd, Rajhans Coke Producers, Industry and Commerce Association, Min-Mec Consultancy Ltd, Durgapur Projects Ltd, TISCO Group of Collieries, participated and explained the need of the industry vis-a-vis the expectation of the industry from CFRI. CFRI was urged to develop Mini Coal Washeries for captive use, to take up work on Environmental Impact Assessment, etc.

In his welcome address, Dr K.S. Narasimhan, Director, CFRI, said that CFRI is preparing to enter the 'market economy' of the 21st century from the protected economy of the 20th century. The crux of this change is customer-oriented operation and economic self-reliance. This is also a part of greater obliga-



Seen on the dais during the Customers' Day at CFRI (from left) are: Shri P.K. Bandyopadhyaya, Scientist, CFRI; Shri A.K. Singh, Chief General Manager, TISCO Group of Collieries, and Dr K.S. Narasimhan, Director, CFRI; and a view of the gathering

tion of development of the nation to make it a global force in the same market economy. In this context, the interaction with the customers has a tremendous importance.



CHEMICALS

Shri Rajesh Kr. Agarwal, Senior Vice President, Dhampur Sugar Mills, expressing his views on behalf of the customers of chemical sector at the Customers' Day observed by CFRI

Dr Narasimhan further said that the mandate of CFRI is research for technological development for Energy Sector which is being maintained by two ways: (1) A service of direct and immediate consequences, and (2) Technology development where customer focus is different. Traditionally, CFRI has been serving all parties who are either producer, processor or user of coal and coal products, a major commercial energy source.

In the course of deliberations, the area leaders gave a brief description of the work carried out in Resource Quality Assessment, Coal Quality Monitoring, Environment, Coal Chemicals, Technology for Coke, Domestic Oven (Chullah), Fly

Ash Utilization and Coal Preparation.

The concluding session was presided over by Shri A.K. Singh, Chief General Manager, TISCO Group of Collieries. In his address, Shri Singh observed that customers-oriented strategic plan is a must to remain as a market force and for that the exercise with the customers by CFRI, an R&D institute, is a novel idea.

Shri Singh also gave away the CFRI Golden Jubilee Awards-1997 for outstanding work in the field of (i) R&D, (ii) Technology development, (iii) R&D Support and (iv) Administration. He also released a book entitled *CFRI Rashtra Ke Hit Mein* and *CFRI Annual Report 1996-97* in Hindi. □

National Conference on Chrysanthemum

THE National Botanical Research Institute (NBRI), Lucknow, organized a two-day 'National Conference on Chrysanthemum' on 4-5 December 1997. Co-sponsored by Council of Scientific & Industrial Research

(CSIR); Department of Science and Technology, Government of India; Council of Science and Technology, Uttar Pradesh, the main aim of this conference was to provide a common platform for discussion between floriculturists and progressive



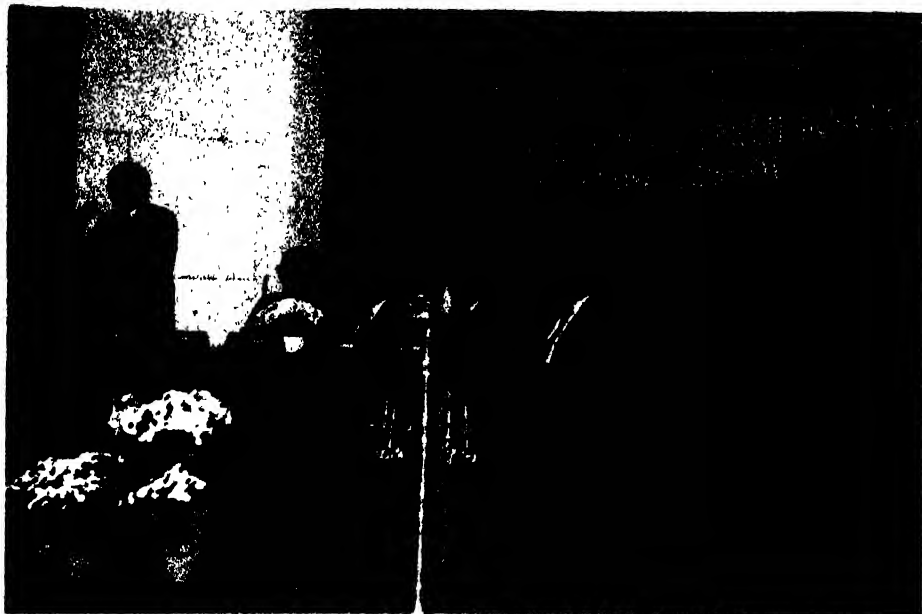
growers about various aspects of research related to chrysanthemum. It was inaugurated by the eminent Horticulturist, Dr S.P. Ghosh, Deputy Director General (Horticulture), ICAR, and attended by over 40 delegates from universities, research institutions, NGOs, and progressive farmers from different parts of the country.

In his inaugural address, Dr Ghosh gave a detailed account of floricultural activities within and outside the country. Stating that most of the technologies in the area, being practised in the country, were from Holland and Israel, he stressed on concentrating on the indigenous technologies. He also mentioned about the importance of mini-culture as it did not require a large space for packaging purpose, and appreciated the role of NBRI for developing chrysanthemum culture.

Earlier, Dr P.V. Sane, Director, NBRI and chairman of organizing committee, while welcoming the chief guest, observed that there was a great potential of culturing chrysanthemum although it still had a small market. He also elaborated on genesis of the conference, which was being held alongwith the annual chrysanthemum and coleus show.

In his introductory remarks, Dr S.K. Datta, Head, Floriculture Section, NBRI and general convener of the conference, spoke about the origin of the conference and its significance of being held at NBRI, a pioneer institution in India, which has done commendable work on various aspect of chrysanthemum.

On this occasion, a new chrysanthemum cultivar selected from open pollinated seedling and christened as 'Mother Teresa' as a tribute



Dr S. K. Datta, Head, Floriculture Section, NBRI, speaking about the genesis of National Conference on Chrysanthemum. Sitting on the dais (from left) are: Dr M.R. Ahmad, Dr P.V. Sane, Dr S.P. Ghosh and Dr B.P. Singh

to the departed Nobel Laureate, was released.

The conference covered aspects such as chrysanthemum germplasm agrotechnology, improvements, diseases and pest management, post-harvest technology, clonal propagation, dehydration and marketing. It called for concentrating on R&D work for evolving new varieties; mass propagation of selected/elite varieties, standardization of cultural

practices; production technology for pot mums and under protected conditions; post-harvest management of cut flowers; studying the effect of growth regulators on vegetative growth and flowering; dehydration of flowers; establishment of databanks; and promoting marketing of the produce by developing the cooperative marketing system. □

Seminar on Commercialization and Cultivation of Medicinal Plants

THE National Botanical Research Institute (NBRI), Lucknow, organized a seminar on 'Commercialization and Cultivation of Medicinal Plants' on 15 December 1997. The objectives of the seminar were to explore commercial opportunities in medicinal plants, identifying shortages owing to export, over-exploitation and collection, promoting cultivation of medicinal plants, identifying poten-

tials and constraints in marketing of raw materials and products of medicinal plants, discussing state-of-the-art agro-techniques and formulating measures to co-ordinate various activities related to medicinal plants.

The seminar was sponsored by Dabur Research Foundation, Ghaziabad. Dr S.K. Jain, Director, Institute of Ethnobiology, Lucknow, was

the chief guest. The programme of the seminar included theme lectures on important aspects like conservation, cultivation, product development and quality control of medicinal plants. Exhibits of some important and promising medicinal plants of this region were also arranged at the site of the seminar. Information on their proper identification and medicinal use was supplied to the participants. Dr S.K. Tewari, Organizing Secretary of the seminar, welcomed the participants. Dr R.R. Rao, Head, Taxonomy and Herbarium Division of NBRI, introduced the chief guest to the audience. Dr B.P. Singh, Senior Scientist, NBRI, dedicated the seminar to Dr P.V. Sane, Director of the institute, and presented him a memento on this occasion.

The seminar had representation from policy makers, researchers, manufacturers and traders, cultivators and extension workers and herbal drug industry. Dr Sane shared his experience in organizing institute's R&D work on medicinal plants. He was of the opinion that scientists working on different aspects of medicinal plants should interact among themselves for better coordination of research work. He stressed the need for developing quality standards of herbal drugs to further increase the export of herbal drugs. The chief guest, Dr S.K. Jain highlighted some neglected aspects of medicinal plants research in India. He stressed the need to create general awareness in the general public, government officials, farmers and researchers.

Dr R.R. Rao gave a lecture on conservation of some important medicinal plants of Himalaya. He said that for efficient conservation, peo-

ple should have a better and clear understanding of the importance and use of medicinal plants found in their area. Dr Arvind Saklani enriched the participants with his presentation on commercialization and cultivation of high altitude medicinal plants. He suggested that for efficient conservation of endangered and threatened species of medicinal plants, there should be a total ban on their collection.

Dr (Smt) S. Mehrotra, Scientist, NBRI, stressed the need for developing quality markets and standards to avoid adulteration and maintaining uniform standard quality. She also expressed concern about the quality of the dried medicinal plants entering the market. Dr S.K. Tewari, Scientist, NBRI, described the agro-techniques of some important medicinal plants. He said that utili-

zation of wastelands and marginal lands was the only option for cultivation of medicinal plants, as the area presently under cultivation of food grain crops could not be substituted in view of increasing demand for food grains with increasing population.

A group discussion was also held on commercial opportunities in cultivation, production, development, quality control and marketing. The seminar recommended that measures are needed to promote the cultivation of medicinal plants and to ensure effective quality control. However, increasing the local interest in collection and cultivation of medicinal plants was considered more appropriate as it would also generate employment for the rural population. □

CRRI Scientists awarded IRC Best Research Paper Medal

SHRI V.K. Sood, and Shri B.M. Sharma have been awarded best research paper medal by the Indian Roads Congress (IRC) for the paper entitled 'Development of Pavement Deterioration Models for Indian Conditions'. The award was presented by Shri Mohamed Shafi Qureshi, Governor of Madhya

Pradesh, at the Annual Session of Indian Roads Congress held at Bhopal in January 1998. Shri Dig Vijay Singh, Chief Minister, Madhya

Pradesh, was also present on the occasion. The research work presented in the paper is an outcome of a long-term study conducted on the performance evaluation of roads in the country. Computer-based models have been presented in the paper for prediction of pavement distress at a later stage with a view

to planning the maintenance strategies. These are the first indigenous models developed based on the work done in the country.

Shri Sood is working as Deputy Director and Head, Pavement Performance Studies at the institute. He is a postgraduate in Highway Engineering and has R&D experience of over 26 years. He has published over 40 papers in various international/national journals and conferences. He has widely travelled abroad.

Shri Sharma is a post-graduate in Highway Engineering and has over 15 years of R&D experience in the institute. He has published over 20 papers in various international/national journals and conferences. He has widely travelled abroad.

A Commendation Certificate has also been awarded to Shri Devesh Tiwari and late Dr A.K. Gupta for the paper entitled 'A Simplified Approach for Location of Bus Stops on Urban Routes' alongwith the other authors during the same session. Shri Sood has also been elected a Council Member of the Indian Roads Congress from Delhi State for 1998. ☐

HONOURS & AWARDS

Shri P.K.Panda and Dr T.S. Kannan

SHR I P.K.Panda and Dr T.S. Kannan of the Materials Science Division of National Aerospace Laboratories, Bangalore, have been awarded for excellence poster presentation, at the third India International Refractories Congress-1998 held at Calcutta during 11-13 February 1998. The title of the paper is 'Finite element analysis of temperature and stress distribution

in a ceramic material subjected to thermal shock'. ☐

Dr V.S. Kishan Prasad

DR V.S. Kishan Prasad, Scientist, Organic Coatings and Polymer Division of Indian Institute of Chemical Technology has been selected for the Dr Husain Zaheer Memorial Award-1996 by the Oil Technologists' Association

of India, for his contribution to the field of polyester imides and membranes. His work has been adjudged to be useful in basic research on novel polymers for surface coatings, compositional studies of partial glycerides formed during alkyd synthesis and development of membranes for concentrating glycerol water and alcohol water mixtures.

The award carries a citation and cash prize. ☐

फॉर्म 4/FORM IV

[नियम 8 देखिए/See Rule 8]

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Names and addresses of individuals who own the newspaper and partners of share holders holding more than one per cent of the total capital.

मैं, _____ एतद्वारा घोषित करता हूँ कि मेरी अधिकतम जानकारी एवं विश्वास के अनुसार ऊपर दिए गए विवरण सत्य हैं।

I, Dr. G.P. Phondke hereby declare that the particulars given above are true to the best of my knowledge and belief.

ता./Dated 15 March 1998

Sd/- G.P. Phondke
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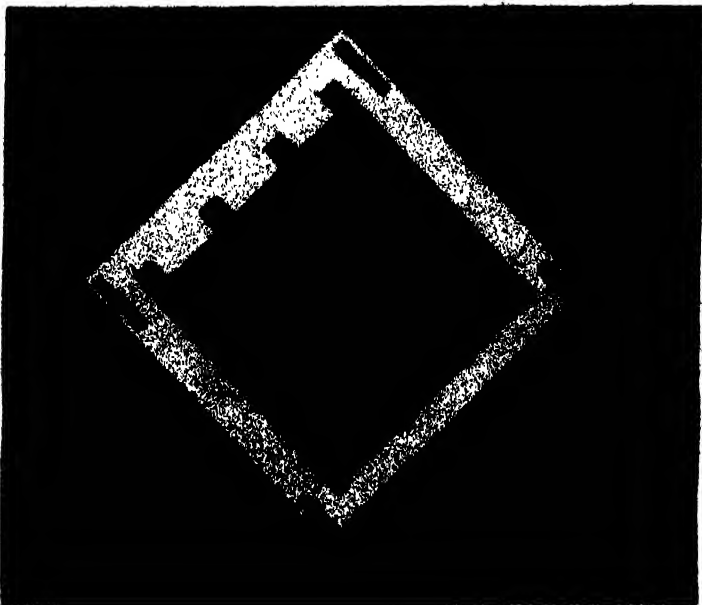
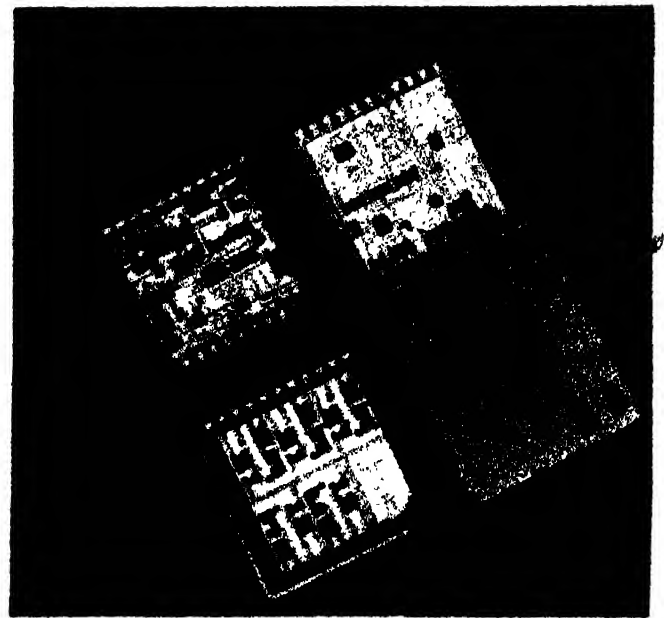
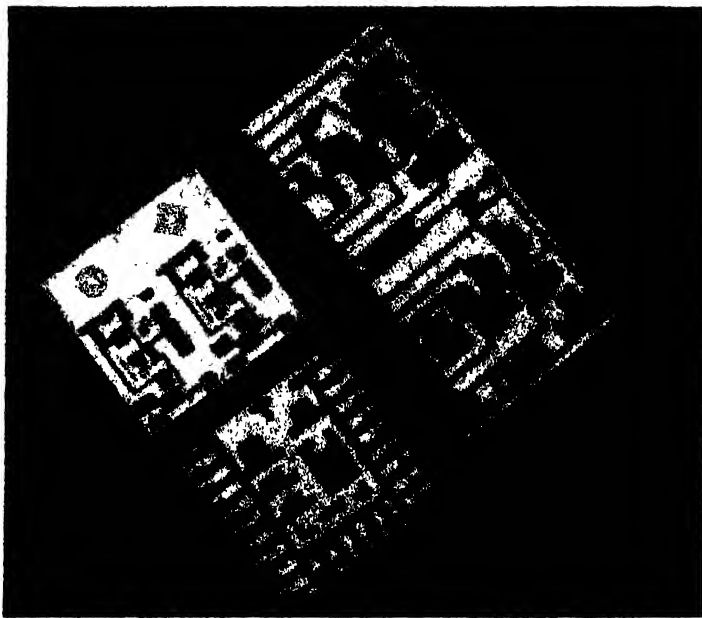
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CSIR NEWS



**R&D at Central Electronics Engineering
Research Institute (CEERI), Pilani :
(Clockwise from top left) Hybrid micro-
circuits for space applications, New
components developed at CEERI,
and Custom built thick film heater
elements**

Thick-Film Hybrid Microcircuits — R & D at CEERI

THICK-FILM process is a sophisticated method of manufacturing hybrid microcircuits (HMCs). A single hybrid functional module may combine the latest components available from the semiconductor industry (including LSI, Bipolar and MOS ICs) with high stability resistors, miniature capacitors and inductors.

Hybrid circuit technology has several advantages such as reduction in weight and volume, reduction in developmental and production costs, better performance specially at high frequencies and harsh environmental conditions, high reliability, and product secrecy. Hybrids find applications in consumer electronics, medical electronics, automobiles, telecommunication, industrial process control, power supplies, electronic instruments and high reliability applications such as Space and Defence.

R&D at CEERI

The R&D on HMC technology is a thrust area programme at Central Electronics Engineering Research Institute (CEERI), Pilani. The reproducibility of the process and reliability of the products have been established and the developed technology is at par with the international industry status. Various types of HMCs have been developed as well as batches produced for a variety of applications. CEERI is the first institute in India to achieve space qualification for HMCs. The HMCs developed have been successfully integrated in SROSS-I, SROSS-II, INSAT-IIA, INSAT- IIB, INSAT-IIC, and INSAT-IID satellites. The know-how for production of HMCs has been

transferred to three Indian industries: M/s Minicircuits Ltd, Bangalore; M/s GCEL, Vadodara; and M/s IL, Kota.

The institute is committed to excellence through its continuous R&D efforts which include:

- Development and characterization of new type of thick-film components namely 'segmented resistor' and 'via-terminating resistor'.
- Development and application of laser ablation technique for fabrication of superconductor quantum interference devices (SQUIDS) under a national project.
- Techniques for laser patterning, development and characterization of fine-line passive components using laser micro machining.
- Deep understanding of charge transport mechanisms in thick

films by detailed study of electrical characteristics and microstructure investigations of process-induced interactions at various interfaces.

Ongoing Projects

Laser Device Packaging — CEERI has taken up the challenging task of packaging of modules consisting of laser devices. This project has been sponsored by CAT, Indore. The basic task is to develop a package for transmitter module which broadly includes: mounting of laser diodes on thermoelectric coolers, necessary interconnections, fibre alignment to laser diode chip to obtain maximum efficiency, fibre attachment to pedestal, and hermetic sealing of the module with provision of fibre pig-tail.

Alumina Bias Board — The project has been sponsored by M/s SPL, Delhi, and involves development of alumina boards to be used with IR detectors. This is a collaborative project and consists of two major activities:

1. Alumina bias boards consisting of 45 biasing resistors of value



Alumina bias board developed for SPL, Delhi

ranging from 1 k Ω to 3.5k Ω are fabricated using thick-film technology at CEERI. Every resistor in each board has a unique value, therefore, no two boards are identical.

2. A complete assembly of alumina bias board-to-flexi-board-to-connector will be made at CEERI. The flexi-boards and connectors required for the assembly will be supplied by M/s SPL.

Stable Metal-to-Metal Interconnection — This project has been under the Young Scientist Award Scheme of CSIR. The objective of the project is development, characterization and interface analysis of joints produced by isothermal solidification technique for different binary and ternary combinations.

An important feature of this technique is to fabricate joints at low temperature which are stable even at relatively high temperatures and the joints thus fabricated will also have high mechanical strength. The finding of the study will establish a low-cost, environment-friendly, metal-to-metal interconnection technique for producing strong and high temperature stable joints.

Refurbishment of Furnaces — This is aimed at upgradation of two conveyor belt furnaces which are being presently used for thick-film fabrication through a PC-based control system.

Micro-controller Hybrid Module — This is again an in-house project, the objective of which is to develop a hybrid module for micro-controller-based stand alone controller application. The hybrid module will have the microcontroller and its associated hardware embedded into it.

Other Activities

In addition to the above, there are some other identified projects which include:

- Development of thick-film heaters for sensor applications as required by IIT, Delhi.
- Development of alarm circuit for LPG sensor as required by IICT, Hyderabad.

Future Plans

CEERI has been continuing its activities to meet national objectives with due consideration to industrial needs.

In the Ninth Five-Year Plan, CEERI will venture into the area of multichip modules (MCMs) using low-temperature co-fired ceramics. □

Speed Indicating and Recording Instrument for Locomotives

A PC-based speed indicating and recording instrument has been developed by the Central Electronics Engineering Research Institute (CEERI), Pilani, in collaboration with Stesalit Ltd, Baddi (Solan) for diesel and electric locomotives. The instrument indicates and records relevant train data such as loco speed, time, date, etc. in NVROM. The prototype model of the instrument has been fabricated

and tested for its performance. The features of the instrument are:

- Non-contact inductive DC-type proximity sensor with IP-67 standard.
- 6-digit odometer with bright LED display and 30 days battery back-up.
- Speed indications:

Analog: over 240° deflection dial



Speed indicating and recording instrument for locomotives developed by CEERI in collaboration with Stesalit Ltd, Baddi, Solan

Resolution: 1 km/h

Accuracy: $\pm 1\%$

Recorder failure

Memory full indication

Over-speed indication with an alarm

- Fully functional keyboard to enter initial data such as name, time, date, loco and train numbers by the loco crew and supervisory access to enter wheel wear adjustment and over-speed limit.

- Recorder unit accepts TTL input from the source of event and stores in flash ROM disk for black box storage of latest 30-minute information such as:

Speed in km/h

Distance in km

Brake pipe pressure (psi)

Real time (hour:min:sec)

Date (dd:mm:yy)

Dynamic brake application

Sounding of Horn status

Notch position status

Traction on/off, and

Normal memory information for the last 30 days, such as: speed in km/h, distance in km, time (hour:min:sec), date (dd:mm:yy)

- Data retrieval is through 3.5" floppy disk drive interface, and a hardware switch for a data transfer to floppy. The retrieved data can be analyzed by using PC/AT in text or graphical format.
- Interactive selection of conditional data for display and analysis.
- Memory freeze option through supervisor.

- The unit is fully enclosed in a tamper-proof cabinet with locking arrangement.

- Speed dependent and distance dependent electrical contacts with contact rating at 120V AC/DC 0.1A.

- Optional provisions:

6-Relay contact outputs with a rating of 120V/AC/DC, 0.1A

8 Expandable TTL compatible digital inputs and outputs

7 Analog inputs with $\pm 0.01\%$ accuracy. ☐

Pigeonpea intercropping augments economic returns from palmarosa cultivation

PALMAROSA (*Cymbopogon martinii* var. *motia*) crop provides poor financial return, owing to lower yield and high cost of cultivation, in the initial year of planting. This restricts its popularity among farmers in India. In the first harvest year (planting year) the plant produces only 60-70% of the tillers normally produced in subsequent harvest years, with a similar reduction in the herbage and oil yields. As a result of the limited plant growth in the planting year, the available growth resources such as light, space, moisture and nutrients are insufficiently utilized. This offers an opportunity for palmarosa growers to opt for an intercrop to make palmarosa cultivation economically viable in the first year of plantation. With this objective in view, studies were carried out at the Central Institute of Medicinal and Aromatic Plants (CIMAP), Lucknow, in two separate field experiments for two years, on two pigeon pea cultivars, Bahar (late maturing) and UPAS-120 (early maturing). These were intercropped with palmarosa in the first harvest year (July-June). Residual effects of intercropping were studied in the second harvest year.

Palmarosa seedlings were planted at a uniform spacing of 60 cm x 30 cm plant x row in first week of July during both the years of experimentation. Three days after the planting of palmarosa, seeds of pigeonpea cultivars were drilled in furrows between the rows of palmarosa at the rate of 2g per one metre row length. Pure crops of cultivars Bahar and UPAS-120 were also sown on the same day at the same seed rate used for intercropping. Palmarosa was harvested three times in a year in October, December, and June in both the first (planting year) and second harvest years. Pigeonpea cv. Bahar was harvested in the first week of April and UPAS-120 in the first week of December in both the years.

Late maturing (240-260 days) pigeonpea cv. Bahar yielded 1260 kg/ha without any effect on palmarosa when intercropped at a distance of 300 cm between the rows. This intercropping is estimated to provide a net return of Rs 34,000 per hectare against Rs 21,500 from only palmarosa. The system improved the land equivalent ratio (LER) by 1.46 and relative net return (RNR) by 1.58. Owing to low yield potential,

early maturing UPAS-120 showed a marginal increase in RNR and net economic return. Pigeonpea was a stronger competitor and palmarosa remained a subordinate species in the mixture. Competitiveness of pigeonpea increased as the row distance decreased from 300cm to

180cm in Bahar and from 240cm to 120 cm in UPAS-120. Tiller production and herb and oil yields of palmarosa decreased as the distance between pigeonpea narrowed, showing greater susceptibility of palmarosa to lack of light. Intercropping did not affect the growth and

herbage and oil yields of palmarosa during second harvest year. The selection of high yielding and late maturing pigeonpea cultivars with upright growth habit has thus been recommended for better economic returns from a palmarosa-pigeonpea intercrop system. □

Elite Banana Tissue Culture Plantation

THE Central Food Technological Research Institute (CFTRI), Mysore, has developed a workable technique to micropropagate virus-free saplings of the elite Nanjangud Rasbale variety of banana. This local elite variety of banana is well known for its sweetness. However, the crop is quite susceptible to virus attacks which

persist through generations, reducing the productivity. Adaptation of the aseptic tissue culture technique developed by the Plant Cell Biotechnology Division of the institute is expected to provide farmers with virus-free saplings of the plant. Three hundred such virus-free tissue cultured saplings are being planted for a field trial at the

CFTRI campus. Shri Ashok Parthasarathi, Secretary, Ministry of Food Processing Industries, Government of India, New Delhi, set the programme rolling by planting the first of the saplings along with Dr V. Prakash, Director, CFTRI and his colleagues who also planted saplings. □



Rapid multiplication of shoot cultures (left) and tissue cultured virus-free 'Nanjangud Rasbale' variety of banana plantlets ready for field trials

Studies on Maximization of Flower Yield in Pyrethrum under North Indian Plains Conditions

AN attempt was made by the Central Institute of Medicinal and Aromatic Plants (CIMAP), Lucknow, to introduce the germplasm of pyrethrum (*Chrysanthemum cinerariaefolium*) from Kashmir and Kodaikanal to Lucknow conditions and study the effect of some plant growth regulators on its flowering response.

All the plants of pyrethrum obtained from the selection BT2 re-

sponded well and flowered profusely. The seeds collected from selection BT2 showed better germination when treated with 100 ppm of GA₃.

A Kodaikanal collection responded satisfactorily under Lucknow conditions with a higher flower yield in the range of 200-250 flowers per plant in the initial year. Foliar applications of GA₃+Kinetin increased the number of flowering plants (45% of treated plants) in Kodaikanal collection under field conditions. GA₃ treated plants possessed maximum number of flowering shoots per plant and contained more number of flowers per plant. Pyrethrin's content increased up to 50% by the application of kinetin (0.74%) as compared to control (0.53%). Scientists envisage that pyrethrum can be successfully cultivated in the north Indian plains as an annual crop. □



Selection BT2 of pyrethrum (Initial stage) at CIMAP, Lucknow

Beneficial Vesicular-Arbuscular Mycorrhizal (VAM) Fungi for Cultivated Mints

VESICULAR-ARBUSCULAR Mycorrhizal (VAM) fungi are present in most soils. These occur in association with a great variety of plants belonging to different taxonomic groups which include a number of medicinal and aromatic plant species like, *Artemisia*, *Ocimum*, ginger, tobacco, roses,

Cymbopogon, lavender and *Mentha*. As VAM fungi differ widely in their ability to enhance plant growth, there is a need to study their growth and behaviour, so that effective isolates may be allowed to infect roots rapidly which may efficiently translocate nutrients to the plant.

At the Central Institute of Medicinal and Aromatic Plants (CIMAP), Lucknow, studies have been carried out to determine the response of inoculation by three VAM fungi (*Glomus aggregatum*, *G. fasciculatum* and *G. mosseae*) on the growth and productivity of six commercially cultivated *Mentha* species namely, *M. arvensis*, *M. cardica*, *M. citrata*, *M. piperita*, *M. spicata* and *M. viridis*.

VAM fungi effectively promoted the growth of all the six *Mentha* species. However, maximum enhancement of plant height, shoot fresh weight, shoot dry weight, root colonization and chlamydospores population were observed in case of *M. arvensis* inoculated with *G. mosseae*. *M. cardica*, *M. citrata*, *M. piperita* and *M. viridis* showed better growth when inoculated with *G. fasciculatum*. *M. spicata* was benefited by the inoculation of *G. aggregatum*. *Glomus aggregatum* showed beneficial influence on shoot biomass production of *M. citrata* (138.8%), *G. fasciculatum* on *M. cardica* (191.4%), *M. arvensis* (164.5%) and *M. citrata* (164.2%) and *G. mosseae* on *M. arvensis* (192.5%) and *M. cardica* (126.9%).

VAM colonization pattern also showed similar trend. Colonization of *Glomus aggregatum* was found to be greater in *M. citrata* (69.4%) and *M. spicata* (65%), *G. fasciculatum* in *M. arvensis* (74.8%) and *M. cardica* (71.9%) and *G. mosseae* in *M. arvensis* (85.5%) and *M. cardica* (65.4%).

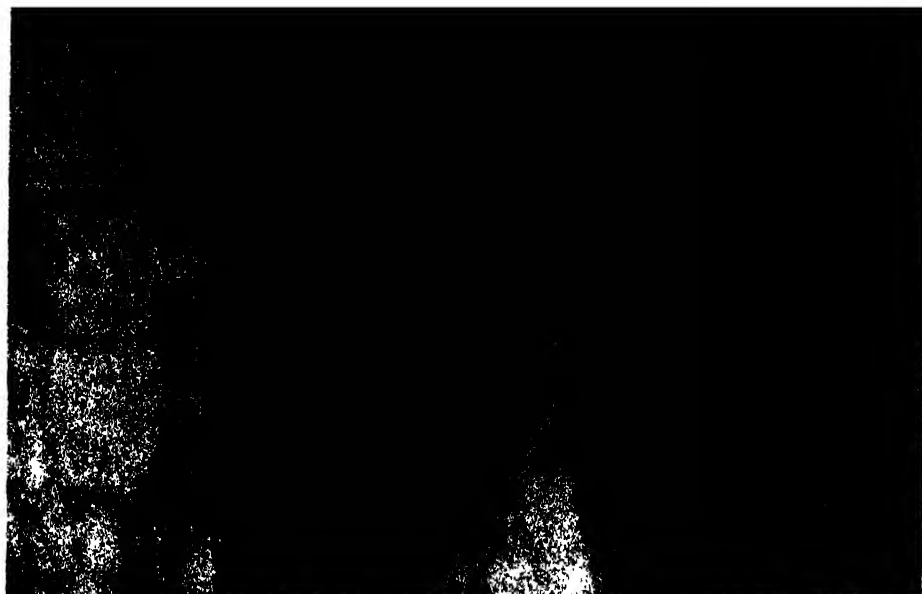
Mentha arvensis inoculated with *G. mosseae* contained higher amount of essential oil (0.63%) as compared to uninoculated control plants (0.59%). *M. cardica* inoculated with *G. aggregatum* also accumulated higher amount of essential oil (0.60%) as against control



(0.50%) plants. In other treatments, increase in essential oil content was not significant.

Inoculation of *Mentha* species with any of the VAM fungi did not effect the major constituents of their essential oils. However, *G. aggregatum* and *G. mosseae* showed enhanced accumulation of menthol and carvone in *M. arvensis* and *M. cardica* respectively.

Though all the six *Mentha* species responded favourably to VAM fungi inoculation, the symbionts showed certain degree of host selectivity as evident from the colonization frequency of the plants by the VAM fungi. *Mentha arvensis* was extensively colonized by *G. mosseae*. Consequently, the association enhanced biomass production as compared to the other two VAM fungi. However, *M. cardica*, *M. citrata*, *M. piperita* and *M. spicata* showed better response to *G.*



Microscopic picture of vesicles and arbuscules of VAM fungi in cortex of mint roots

fasciculatum and *M. spicata* to *G. aggregatum* inoculation. Therefore, a degree of selective effectiveness among the three VAM fungi used for inoculating *Mentha* species can not be ruled out. This emphasizes the need for careful screening of VAM

fungi before large scale inoculation programme. It was envisaged that as cultivated *Mentha* species respond well to VAM-mycorrhization, inoculation of these crops with VAM fungi would be of potential use for improving their productivity. □

NATIONAL ENVIRONMENTAL ENGINEERING RESEARCH INSTITUTE NAGPUR, R&D Highlights

SUSTAINABLE development warrants pursuance of an effective R&D programme enabling solutions to the environmental problems emanating from developmental imperatives in various socioeconomic sectors. The National Environmental Engineering Research Institute (NEERI), Nagpur, while fulfilling its commitment towards national and societal missions, is making significant contributions to the following CSIR and its own R&D thrust areas: Environmental Monitoring; Environmental Biotechnology, Toxic Waste Management; Environmental Systems Design, Modelling and Optimization; Environmental Impact & Risk As-

essment; and Environmental Policy Analysis. The institute's technologies ready for transfer include those related to: Biotechnological conversion of lignocellulosic substrates to cellulase, liquid glucose and value-added chemicals; Biotechnological production of biosurfactants; Production of biodegradable plastics from industrial wastewaters; Biobeneficiation of coal containing high pyritic sulphur and ash; Desulphurization of gaseous fuels and emissions; Biotechnological recovery of hydrocarbons from oily sludges; Oil spill remediation & treatment of petroleum refinery wastewaters; Bioremediation of mine spoil dumps; Low-cost, non-

noble metal-based catalytic converter for controlling auto-exhaust emission; and Diesel particulate filter.

A major extra budgetary resource earner among the CSIR institutes, NEERI's EBR amounted to Rs 120.4 million vis-a-vis CSIR budget of Rs 73.1 million during 1995-96, and Rs 229 million in 1996-97 as against the CSIR budget of Rs 82.8 million (including an incentive grant of Rs 9.3 million and Rs 10 million for purchase of equipment corresponding to the EBR in 1994-95 and 1995-96, respectively). The Net Laboratory Reserves during 1995-96 and 1996-97 stood at Rs 28.4



million and Rs 24.3 million respectively. The R&D carried out at the institute resulted in 40 publications in national journals and 45 in international journals during 1995-96. These publications created average total impact factor of 1.392; contributions from the international and national publications creating impact factor of 2.606 and 0.312 respectively.

NEERI has been undertaking a large number of collaborative/sponsored/consultancy projects. During 1995-96, it signed six new MoUs, and had 40 ongoing projects for which agreements had been entered into earlier. The six MoUs signed during 1995-96 are with: RTZ Technical Services Limited, Bristol, UK, for the preliminary environmental assessment of mines, ports and railway routes in the Keonjhar district of Orissa; Delhi Pollution Control Committee, for design, installation and commissioning of common effluent treatment plants covering twenty eight industrial estates in Delhi; Municipal Corporation of Delhi, for solid waste management in the MCD area; Bharat Heavy Electricals Limited, Jagdishpur, for development and commercialisation of metal substrate based catalytic converter; M/s Paramount Pollution Control Ltd, Vadodara, for EPC of environmental management systems pertaining to various industries; and Cochin Refineries Limited, Ambalamugal, for monitoring of ambient air quality and fugitive emissions.

The ongoing MoUs included those with: ChemControl A/S, Copenhagen, on hazardous waste management project involving technical review of site identification and selection of technologies; Shama Management and Consultants Private Limited, Singapore, for

collaboration in the areas of environmental impact and risk assessment, design of environmental management systems, and participation in joint venture projects for dissemination of innovative environmental technologies; Multiservice Engenharia Ltda, Brazil, for collaboration on enhancement of environmental quality through various projects and action plans; Ministry of Non-conventional Energy Sources (MNES), for the implementation of UNDP programme on development of high rate biomethanation processes as means for reducing green house effect; Tata Energy Research Institute (TERI), New Delhi, to conduct studies on physical resource accounts and valuation of energy, environment, health, minerals and agricultural resources for natural resource accounting in Yamuna River Sub-basin; Mitsui & Co. Environmental Engineering Trust (MEET), Japan, for development and dissemination of environmental preservation technology, and to undertake joint research & developmental studies on various measures relating to environmental protection with Japanese institutions; Oil & Natural Gas Commission, Dehra Dun, for enhancement of environmental quality around oil & natural gas exploration and processing sites; Reliance Industries Limited, Mumbai, for enhancement of environmental quality around RIL production plants, and storage & warehouses through various projects and action plans; Oil India Limited (OIL), Rajasthan, for studies on comprehensive environmental impact assessment for proposed gas gathering station at Dandewala in Jaisalmer district; Ministry of Environment & Forests, New Delhi, for the establishment of a ENVIS Centre in the area of solid and hazardous wastes; Indian Petrochemical Corporation Limited

(IPCL), on projects related to enhancement of environmental quality around IPCL facilities; Oil India Limited (OIL), Duliajan, for studies on comprehensive environmental impact assessment for non-associated oil/gas fields in Upper Assam; and M/s Blue Star Limited for the design of process packages on wastewater management of coke oven & coal gasification effluents. In addition, an Indo-US collaborative project on 'Industrial complexing of phosphatic fertilizer and cement industries', and an Indo-Swiss project on 'Environmental Biotechnology' are being pursued. Also, the institute won the prestigious Rajiv Gandhi Sulabh Sanitation Award (1996), carrying a sum of Rs 0.2 million, a gold plaque, and a citation, for its R&D contributions.

An account of R&D accomplishments of the institute during 1996 is given below:

Environmental Monitoring

National Ambient Air Quality Monitoring — NEERI is operating a nation-wide air quality monitoring network since 1978. A database is being generated on air quality for ten major Indian cities, viz. Ahmedabad, Calcutta, Chennai, Delhi, Hyderabad, Jaipur, Kanpur, Kochi, Mumbai and Nagpur under the programme sponsored by the Central Pollution Control Board in 1990. The database is utilized to evaluate long-term air-quality trends for health-related criteria on pollutants such as inhalable dust, sulphur dioxide, nitrogen dioxide, hydrogen sulphide, ammonia, lead, and polycyclic aromatic hydrocarbons. Air Quality Exposure Index (AQEI) has been used to assess the combined impact of SPM/RSPM, SO₂ and NO₂ concentrations on air environment.

The estimated AQEs for the eco-sensitive zone, viz. Doon Valley, and the urban zone, viz. NCR, indicate that the grid containing DehraDun city and Doiwala area in Doon valley; and major cities, viz. Delhi, Panipat, Faridabad, Ghaziabad and Meerut in NCR fall under the dangerous category owing to the pollutants.

Audit of GEMS/Air Monitoring Stations in South East Asia Region

— The WHO data bank on Ambient Air Quality (AAQ) provides a basis for trend analysis at national and international levels. WHO has retained the institute for conducting audit studies and reviewing technical aspects of monitoring networks to assure generation of scientifically reliable data under the GEMS/AIR programme in three participating countries in the South East Asia region, viz. India, Indonesia and Thailand. The review studies conducted thus far in India, Sri Lanka and Myanmar show minor deviations (<10%) at each stage of flow rate measurement and chemical analysis. A major discrepancy has been observed in the processing of data on NO₂ for a specific monitoring technique.

Surveillance of Aerobiopollutants — The institute has carried out these studies in Nagpur under the MEF-sponsored All India Coordinated Project on Aeroallergens and Human Health. Aeromycological survey from outdoor environment has shown the presence of 23 fungal species, and the presence of 16 fungal species from indoor environment, in the ambient air environment of Nagpur.

Water Quality Studies — Investigations have been carried out for the Hyderabad Water Supply and Sewerage Board to conduct water

quality studies in a 100 km stretch between Srisailem and Nagarjunasagar dams on Krishna river to augment water supply by 410 mld of treated water to Hyderabad city. Treatability studies on water samples from the proposed raw water intake point at Sunkishala in Nagarjunasagar have shown that the conventional treatment comprising alum coagulation, flocculation, sedimentation, filtration, and disinfection with chlorination will provide water conforming to the CPHEEO drinking water quality standards.

Studies for improving a clarifilter-type water treatment plant situated at PTP Nagar, Thiruvananthapuram, have been carried out for the Kerala Water Authority (KWA). Detailed recommendations have been delineated for improvements in the performance of the water treatment plant.

Studies on trihalomethanes, pesticides, heavy metals, and nitrogenous and phosphatic materials in Mumbai Water Supply have also been conducted for the Brahnumumbai Municipal Corporation.

Biosensor for Monitoring Pesticide Residues — This DBT-sponsored project relates to the development of biosensor for detection and estimation of organophosphorus pesticide residues in natural water. These pesticides are potent inhibitors of enzyme acetylcholinesterase (AChE). The enzyme AChE is immobilized using covalent crosslinking with Bovine serum albumin (BSA) and glutaraldehyde and applied on to the electrode. Various environmental conditions, viz. pH, temperature, substrate concentration, pesticide concentration and enzyme-pesticide contact time have been optimized for the sensor. The

biosensor is easy to use and provides real-time data on measurements of trace concentrations of organophosphorus pesticide residues in water under field conditions.

Environmental Biotechnology

Multiplex PCR for Environmental Monitoring

— Protocols for the PCR technique have been established in the DBT sponsored project for monitoring the microorganisms. The protocols allow simultaneous surveillance of enteropathogens in routine and post-epidemiological monitoring of water quality. Organism-specific PCR protocols have been established for the detection of *E. coli*, *Salmonella* and *Vibrio*. These protocols have been extended to duplex PCR, wherein two organisms are detected simultaneously in a single reaction. The presence of *E. coli* indicates fecal contamination, and the probable presence of enteropathogens.

In addition to monitoring pathogens, the PCR protocol has been developed for the detection of hydrocarbon utilizing genotypes (aromatic, halogenated, and phenolic compounds) in soil samples.

Molecular Genetics for the Management of Aromatics in Waste

— Investigations on this Indo-Swiss collaborative project relate to the problem of contamination caused by substituted phenolic wastes from industries. Model xenobiotics used to comprehend the regulation of degradation are *p*-nitrophenol (PNP) and *m*-aminophenol (MAP). PNP/MAP utilizing organisms have been isolated from soil and effluents contaminated with nitroaromatic compounds. Four different isolates



(S₁, S₂, ST1 & SF1) have been selected to study PNP degradation. The kinetics of degradative capacity in these organisms is now being investigated with recourse to chemostat experiments.

Construction of Genetically Engineered Strains for Microbial Desulphurization of Petroleum — Under this DBT sponsored project, dibenzothiophene has been transformed to a fluorescent metabolite, 2-hydroxy biphenyl. The genes encoding enzymes involved in this transformation have been cloned into a broad host range vector, and transformed into competent hosts, *E. coli* and *Rhodococcus sp.*

Bioremediation — Under this DBT-sponsored project, a PCR based technique has been developed for the determination of specific genotypes of microorganisms capable of transforming hydrocarbons in contaminated soil at hazardous waste dump sites. The technique is useful not only in landfill site selection and characterization, but also in isolation of versatile microorganisms with novel and broad metabolic capabilities for generation of microbial inocula in treatment of specific hazardous wastes.

The cells of genetically engineered *Pseudomonas putida*, coexpressing cytochrome P450 cam and luciferase efficiently dehalogenate hexachloroethane to tetrachloroethylene, pentachloroethane to trichloroethylene and 1,2,3,4,5,6-hexachlorocyclohexane (-Lindane) to 3,4,5,6-tetrachlorocyclohexene at rates that are 3-6 folds higher than the natural strains. The study demonstrates that alternative electron transfer partners may be exploited

for cytochrome P450 dependent bioremediation strategies in the bioremediation of chlorinated hydrocarbon wastes.

Microbial Desulphurization of Claus Tail Gas at Mathura Refinery — The refinery has retained NEERI for design and installation of a full-scale plant for chemo-biochemical desulphurization of Claus tail gas. The proposed plant for desulphurization of Claus tail gas is to include cooling system for tail gas, caustic scrubber for selective removal of sulphur dioxide (SO₂), chemical oxidation unit for treatment of H₂S with concomitant production of elemental sulphur, sulphur recovery units, fixed-film bioreactors for regeneration of oxidant for reuse, and heating system for treated gas prior to its release into the stack.

Microbial Desulphurization of Biogas and Recovery of Elemental Sulphur — A two-step biotechnological process for desulphurization of gaseous fuels and emissions with concomitant recovery of elemental sulphur from the gas has been developed by the institute.

The pilot unit based on this process has been designed. The system is sponsored by the Ministry of Non-conventional Energy Sources, and M/s Vam Organic Chemicals Ltd. The unit is designed to treat 100 m³ per hour of biogas generated from the distillery spent wash, containing 2 to 3% of H₂S.

Toxic Waste Management — Investigations have been carried out on: Biodegradation of industrially significant chloroaliphatics and chloroaromatics in sequential anaerobic-aerobic environments; Site identification and selection of technology for hazardous waste management in India; and Industrial

complexing — A solution to phosphogypsum fertilizer waste problem.

Genotoxicity of Hazardous Chemicals and Wastes — Studies have been carried out on genotoxicity by measuring DNA-damaging potential of the extracts of soil contaminated with pesticides from a carbamate manufacturing industry in Central India. Both carbaryl and alpha naphthol singly, or in combination, induced *in vitro* DNA damage in human leucocytes. Experiments are now underway with cyclin D, and E antibodies to determine overproduction of cyclin in cultured mammalian cells after exposure to toxic chemicals.

Protocol for Evaluation of Toxicity of Industrial Effluents — This multi-institutional project, sponsored by the CPCB, is aimed at the development of a national protocol for evaluation of toxicity of complex industrial effluents, and introducing toxicity as a parameter in Minimal National Standards (MINAS) for regulatory purposes. The other participating laboratories in this project are: CPCB, Delhi; ITRC, Lucknow; NIOH, Ahmedabad; and the State Pollution Control Boards in Karnataka and Gujarat.

Studies in the first phase relate to: Development of a national protocol for deriving 'No Observed Effect Concentration (NOEC) and Toxicity factors (Tf)' in short-term bioassay tests. The protocol has been calibrated and validated through inter-laboratory testing of 21 coded synthetic effluent samples with Toxicity factors (Tfs) between 16 and 358,400. Investigations carried out under the second phase relate to the evaluation of effluents from pesticide industries.

Environmental Systems Design, Modelling, and Optimization

Indigenous Catalytic Converter and Diesel Particulate Filter Technologies for Auto-exhaust Emission Control — The R&D on non-noble and noble metal based three-way catalytic converter is in progress. The surface area of cordierite supports has been improved to the desired level of 20-25m²/g through alumina washcoating process which has been developed and standardized at the institute. The development of metallic substrate-based catalytic converter has been undertaken now under the sponsorship and collaboration of the Bharat Heavy Electricals Ltd (BHEL). Zeolite based catalyst formulations are also being evaluated for their application as auto-exhaust catalysts.

An improved Diesel Particulate Filter (DPF) has been developed and

tested for its smoke-reducing capacity in diesel-driven vehicles. An in-house research programme has been initiated on the development of improved auto-exhaust emission control technologies to meet the stringent autoemission standards proposed for the year 2001 AD. A genetic algorithm based software will enable the optimal design of catalytic converters for various vehicle types.

Upgradation of Effluent Treatment Plant at Hindustan Insecticides Ltd, Udyogamandal — HIL has retained the institute to examine the performance of the existing plant and suggest modifications to ensure that the characteristics of pesticides in the effluents, viz. DDT, BHC and Endosulphan, conform to the revised standards stipulated by KSPCB. The engineering package supplied by the institute includes the wastewater characterization, details of treatability study, and comprehensive wastewater management plan incorporating the design of additional treatment units.

High Rate Biomethanation System at RRL, Bhubaneswar — Based on fixed film-fixed bed reactor technology developed at the institute, a 400 m³/day capacity high rate biomethanation plant has been designed, constructed and commissioned by the institute at RRL, Bhubaneswar. The biomethanation plant has been jointly financed by the MNES, Government of Orissa, and RRL, Bhubaneswar.

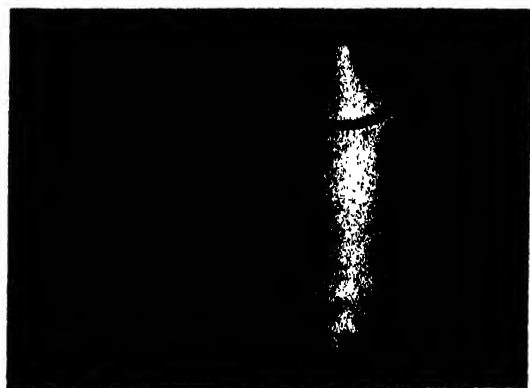
Design and Installation of CETPs — The Delhi Pollution

Control Committee (DPCC) has retained the institute for the design and assistance in installation of Common Effluent Treatment Plants (CETPs) in 28 industrial estates in NCT, Delhi.

Under the sponsorship of the Government of Rajasthan, NEERI has designed CETPs for 775 textile units at Pali. The construction of these plants has been undertaken by the Rajasthan State Bridge Construction Corporation (RSBCC), and is scheduled for completion in June 1998.

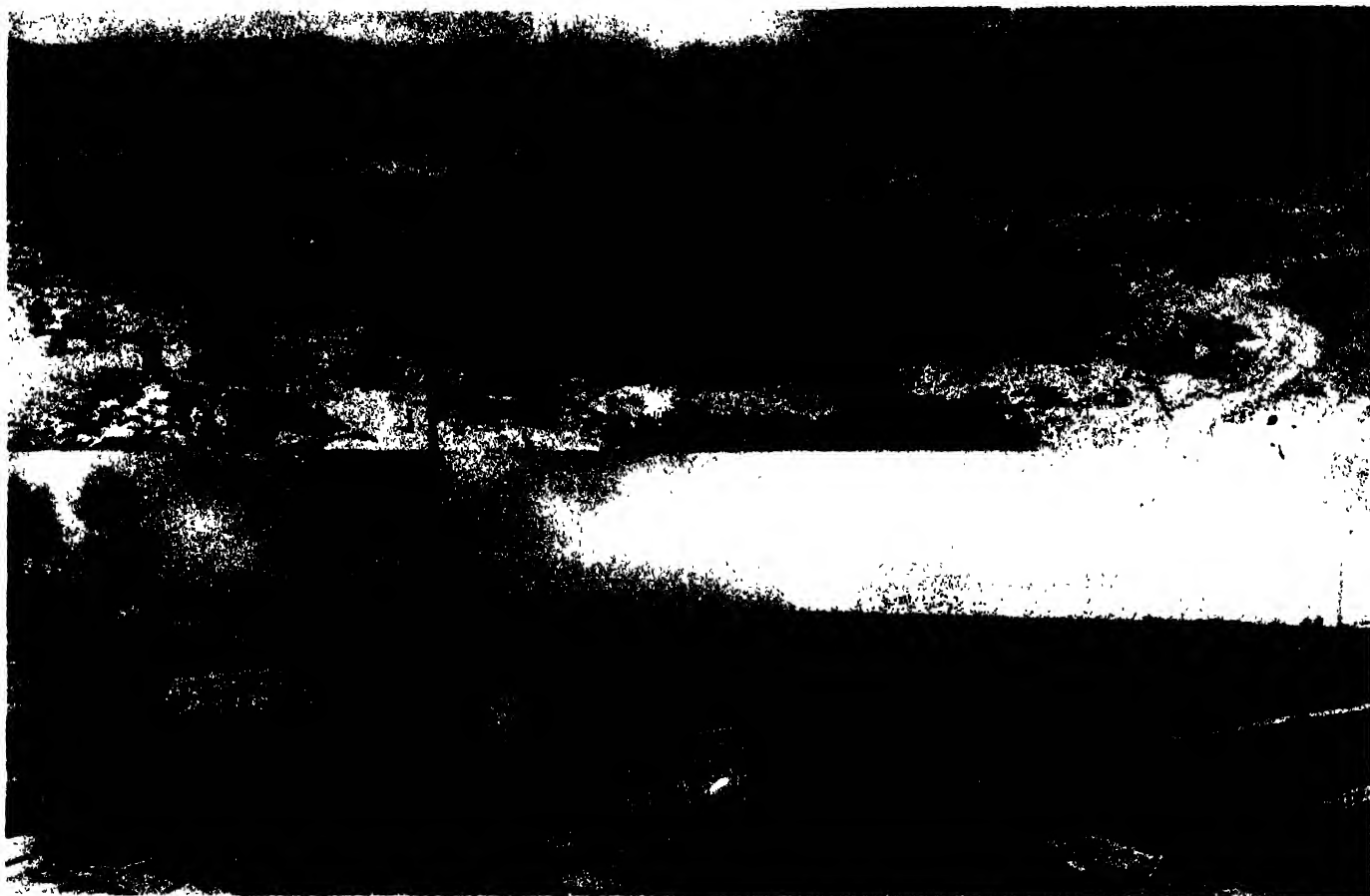
Wastewater Renovation with Recourse to Soil Aquifer Treatment System — This project sponsored by the Ministry of Water Resources, in collaboration with the Physical Research Laboratory (PRL) and Ahmedabad Municipal Corporation (AMC), involves wastewater renovation by infiltration through soil matrix. In the first phase of the project, infrastructural facilities for SAT system, viz. two setting basins, two infiltration basins, two tubewells (recovery wells), and a number of piezometers have been constructed in the Sabarmati riverbed. Pumping tests have been conducted for the assessment of aquifer parameters, viz. hydraulic conductivity, transmissivity, storage coefficient and dispersivity.

A pilot plan with a capacity of 5000 m³/day has been operated under varying experimental conditions of sewage inflow rate, and flooding/drying cycles to assess the efficacy of the natural riverbed on the removal of SS, BOD, COD, nitrogen, phosphate, and bacteriological characteristics. These results have established the feasibility and efficacy of the SAT system under the prevailing climatic and physical conditions at the Sabarmati riverbed



Testing prototype of two-way catalytic converter (top); Testing prototype of diesel particulate filter (above)





A view of under construction CETP at Punayata Road, Pali (top) and at Mandia Road, Pali (above)

in Ahmedabad. A mathematical model has now been developed, calibrated, and validated to enable wider application of SAT systems to other locations in India.

Treatment and Disposal of Wastewater through High Rate Transpiration system — The institute has undertaken collaborative R&D with the Orissa State Water Supply and Sewerage Board to design and implement a High Rate Transpiration System (HRTS) for treating municipal wastewaters of Puri town to prevent sea beach pollution. The HRTS has been installed in specially designed ridges and furrows, provided with 10 cm thick coconut waste filter media over an area of 3 hectares, and planted with

10,000 saplings of *Casuarina* (*Casuarina equisetifolia*) and *Acacia* (*Acacia mangium*).

Studies on treatment and disposal of pulp and paper mill wastewater using HRTS, for the Orient Paper Mills, Amlai, have also been made.

Development of Elite Clones of Plants through Tissue Culture — Plantlets of neem and pomegranate have been regenerated through meristem culture using modified Murashigae and Skoogs (MS), and Gamborgs media, respectively.

The plantlets of neem and pomegranate have been transferred to the natural soil ecosystem on the institute's premises, and on manganese mine spoil dump at Gumgaon,

near Nagpur after the process of hardening. The regenerated plants show multiple branching and increase in plant height.

Studies are now underway on propagation of these plants through callus culture and somatic embryogenesis. The characterization of plants vis-a-vis pollutant tolerance and concomitant changes in biochemical contents are also in progress.

Solid Waste Management in MCD Area of NCT, Delhi — The Municipal Corporation of Delhi has retained the institute, to evaluate the existing system and identify areas of improvement for delineation and implementation of an action plan for solid waste management problem in Delhi.



Tissue cultured neem plant at the institute gardens, planted on 11 November 1995 (left) and pomegranate plant at Gumgaon Manganese Mine Spoil Dump, planted on 15 January 1996

Genetic Algorithm for Optimization of Water Distribution Systems — A methodology based on genetic algorithm (GA) has been developed at the institute for low-cost design of new water distribution networks, and augmentation of existing water distribution networks. Genetic algorithms are nature-based stochastic computational techniques with the broad advantages of applicability, flexibility and potential for finding near global optimal solutions.

The results of water distribution system design based on GA have been compared with those employing NLP technique based on interior penalty function with Davidon-Fletcher-Powell method.

Optimal Design of Branched Water Distribution Systems — A ra-

tional procedure based on Lagrangian Multiplier technique has been developed at the institute for optimal design of new branched water distribution systems, or for augmentation of an existing system. It takes into account the need to provide minimum service pressures at all demand nodes (including the interior nodes) in an uneven terrain, and the cost of all major components in the system including the cost of pumping, energy, and the service reservoir(s).

Environmental Impact and Risk Assessment, and Environmental Audit

Environmental Impact Assessment (EIA) establishes quantitative values for parameters indicating the

quality of environment and natural systems before, during, and after the proposed developmental activity. Environmental Management Plans (EMPs) prepared by the institute ensure that the resources are utilized efficiently and optimally in the production processes, waste generation is minimized, residues are treated cost-effectively, and by-products recovered and recycled to the maximum extent possible. This overall strategy not only cuts down environmental management costs but also results in substantial savings in the cost of production. EIRA, EA and Carrying Capacity Studies on 29 projects have been completed during 1995-96 and on 27 projects are in progress. Details of other studies on environment impact are given below:

Environmental Impact Assessment Studies at Antarctica — The Department of Ocean Development (DOD) sponsored a project to the institute to conduct environmental impact assessment of human activities at Maitri, the permanent Indian Station at Antarctica. The environmental assessment at Maitri indicates that soil is contaminated with spent oil discarded from various units. An Environmental Management Plan has now been delineated for execution at Antarctica comprising the identification of principal sources of wastes at Maitri along with quantities, and characteristics, and measures to reduce/reuse/recycle for PVC products to ensure that the storage, transportation and disposal of wastes are in accordance with the international protocols.

Capacity-based Developmental Planning for Socioeconomic Development in National Capital Region (NCR) — The Ministry of Environment & Forests has retained the institute as the coordinator of a multi-



Oil contaminated site (top) and leakage of wastewater at Maitri (above)

institutional study for the establishment of regional assimilative capacity with respect to air, water and land components of environment, as also for the supportive capacity of human, institutional, and natural resources in the NCR.

Two time horizons were chosen for generating developmental scenarios. The short-term scenario, for 2001 AD, aims at enhancing the quality-of-life levels of inhabitants with emphasis on environmental

upkeep. The long-term scenario, for 2021 AD, aims at enhancing the equitable quality of life levels, minimizing ecological loading, and maximizing regional gross-ecological-product with least environmental degradation.

The overall recommendations from the study include the constituent tasks in development planning in the region after detailed analyses of existing situation and NCR Planning Board's proposals, as also the

salient features of preferred scenarios for 2021 AD in terms of policy reforms, technological interventions, and institutional capacity building.

Natural Resource Accounting in Yamuna River Sub-basin — The MEF, in March 1995, retained the institute as the coordinator of a multi-institutional study on the preparation of Natural Resource Accounts in Yamuna river sub-basin so as to provide a basis for prudent management of economy.

The accounting framework devised for Yamuna river sub-basin delineates natural resource stocks and use patterns, emissions, and environmental protection expenditure for salient activities including those by the informal sector. The inventories of air, water, land, forest, biodiversity and energy resources have been systematized to evolve a decision support system to delineate policies, including market oriented instruments, for sustainable economic growth in the region.

Based on the costs of environmental degradation, the following prioritization of environmental actions are delineated: Control on groundwater abstraction; Industrial and vehicular gaseous emissions control; Protection of landmass suitable for agriculture; and Protection of Delhi ridge forest.

Environmental Policy Analysis

Regional Plan for Ecologically Fragile Dahanu Area and its Environmental Viability — Dahanu Taluka in the state of Maharashtra has rich land, forest, aquatic and aesthetic resources. The coast line is about 85 km long. In 1989, the area under wetlands and mudflats constituted 9546 hectares, tropical moist



teak bearing and mixed deciduous forests and mangroves 66261 hectares and plantations 5189 hectares.

The Ministry of Environment and Forests declared the Dahanu Taluka in June 1991 as environmentally sensitive, and delineated restrictions on industrial activities and land use changes. The Coastal Zone Regulations, promulgated in February 1991, regulate the land use within 500 meters buffer zone of the high tide line.

The judiciary directed the institute in October 1996 to examine the following issues relating to: Conformity of Regional Plan in respect

of Dahanu area formulated by the Government of Maharashtra: Environmental viability of the Regional Plan; Delineation of suggestions to protect and preserve ecology in Dahanu region; Typology of industries to be permitted in ecologically fragile Dahanu region; and Examination of the impact of the thermal power plant operating in Dahanu region. The institute's report, submitted in October 1996, deals with these issues elaborating conclusions and recommendations on each issue.

Water Resources Management in India — The judiciary, in September 1996, directed the institute to examine the matter of declining

groundwater levels in the country and to submit a report delineating suggestions and recommendations for checking further decline in the underground water levels. The fall in groundwater levels is intricately linked to the hydrological regime that comprises both surface and ground waters, and is dependent on prevalent land use. In keeping with this fact, the subject matter was addressed in the institute's report submitted in September 1996, with a hydrological perspective linking groundwater-surfacewater quantity/quality issues with land use. □

CBRI-Industry Meet & Technology Showcase

As a part of its Golden Jubilee celebrations, the Central Building Research Institute (CBRI), Roorkee, in collaboration with Karnataka Small Scale Industries Association (KASSIA), Small Industries Services Institute (SISI), and CSIR Polytechnology Transfer Centre (PTC) at Bangalore, organized an 'Industry Meet & Technology Showcase' on 24-25 November 1997, at Bangalore. The event was sponsored by 13 establishments including some licencees of CBRI technologies, CSIR, HUDCO, KVIC, etc. It was attended by about 250 participants.

The Meet and Technology Show-Case were inaugurated by Shri C.M. Udasi, Minister for Public Works, Government of Karnataka. The key-note address was delivered by Shri V. Suresh, CMD, HUDCO. An informative souvenir brought out on the occasion was released by Shri Suresh.

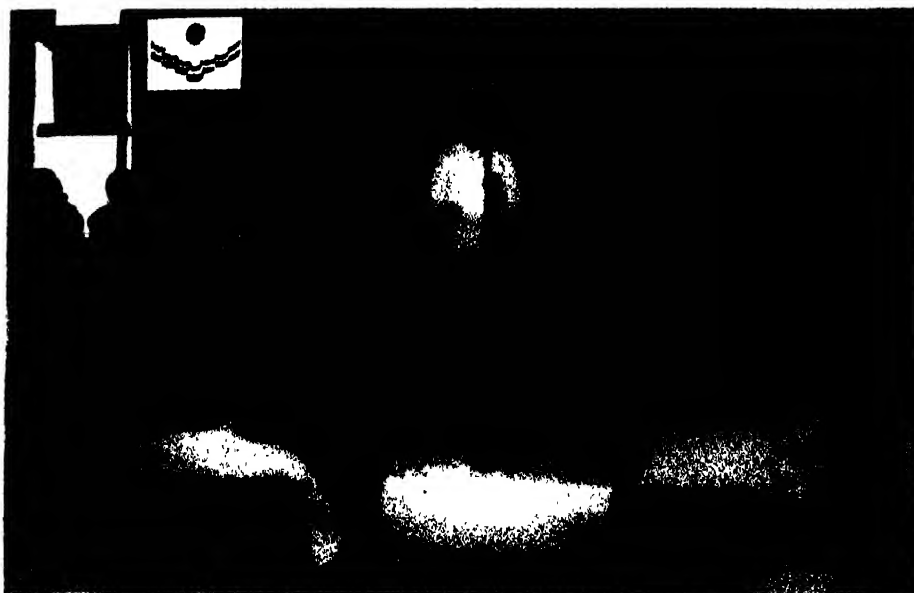
The showcase displayed the technologies developed by CBRI, and the products of CBRI licencees. The entrepreneurs were also informed about the various testing and

infrastructure facilities available at the institute. An exhibition was also arranged on this occasion which was inaugurated by Shri Udasi.

The following technologies were displayed and offered to the industries for exploitation: IPN-Anti-corrosive Coatings; EPS-Door Shutters; Polytiles; Clay Flyash Bricks; Sand-Lime Bricks; C-Bricks; Coir

Cement and Coir CNSL Board; Cement, Lime and Gypsum Products; Fire Retardant Doors and Textiles; Fire Barriers and Stops.

Expert know-how for the following technologies was provided to the participants: termite and building pest control; rehabilitation of distressed buildings; disaster mitigation; energy efficiency of buildings;



Shri C.M. Udasi, Minister for Public Works, Government of Karnataka, delivering his inaugural address, during the CBRI - Industry Meet & Technology Showcase

software for planning and design; fire spread modelling; vibration monitoring; post-fire investigations and risk analysis of industrial plants.

Participants were also informed about the following processes and technologies; viz. brick-making machine; high draft kiln; mini climbing crane; concrete block making machine; lime kiln and hydrator and its pollution control system; automatic free fall hammer; boring and skirting machine; cost-effective construction technologies; partial prefabrication for mass housing; electric curing of concrete pole and pile integrating testing.

Shri P. Kotilingana Gowda, MD, Karnataka, Small Scale Industries Development Corporation, Bangalore, delivered the valedictory address. Prof. R.N. Iyengar, Director CBRI, presided over the inaugural and valedictory functions. □

HONOURS & AWARDS

Dr D.C. Goswami

DR Dinesh Chandra Goswami, Scientist, and Head, Planning Division, Regional Research Laboratory (RRL), Jorhat, has been awarded the National Council for Science & Technology Communication's (NCSTC's) 'National Award for Best S&T Coverage in the Mass Media'



for the year 1997. He received the award at the hands of Prof. Y.K

Alagh, the then Minister of State for Science & Technology, at a function held in DST, New Delhi, on 28 February 1998. The award carries a bronze medal, a citation scroll and Rs 50,000.

This award is presented for outstanding coverage through mass media (print, radio, television, film) during the period under consideration.

Dr Goswami has been contributing towards popularization of science for over 25 years. He has published 12 popular science books during the last five years. He has written about 350 articles including science fiction short-stories and dramas in various newspapers and magazines. He is a regular science column writer in a number of popular science and other magazines. His broadcasts include regular popular

ANNOUNCEMENTS

National Seminar on Batteries and Fuel Cells

AS a part of its golden jubilee celebrations, the Central Electrochemical Research Institute, (CECRI), Karaikudi, is organizing a National Seminar on 'Batteries and Fuel Cells' at CECRI during 14-15 May 1998.

This seminar is aimed at providing an opportunity to the scientists and engineers working in the field of Batteries and Fuel Cells in different research, academic, industrial, and testing organizations, to exchange views and to acquaint themselves with the latest developments in the field. Papers will be presented in the areas of primary batteries, lead-acid batteries, secondary alkaline batteries, lithium

batteries, fuel cells, electric vehicle batteries, solid-state batteries, battery safety, quality and testing and also recycling of battery waste and pollution control in battery industries.

An exhibition will also be arranged for displaying battery and battery-related products like battery making machinery, testing equipment, components like containers and separators and also raw materials like cathode and anode materials and current collectors.

For further details, please contact: Dr P.G. Balakrishnan, Convener, National Seminar on Batteries and Fuel Cells, CECRI, Karaikudi 630 006. □

science and science fiction from Guwahati, Jorhat and Dibrugarh centres of All India Radio. He has translated a number of popular science books in Assamese. He has received three awards from Asom Sahitya Sabha and a national prize for children's literature in popular science. He regularly delivers talks on various scientific topics every year, organizes science motivation courses for the tribal, SC/ST and general students in the North-Eastern region. Since 1984, he has been editing and publishing a single topic, popular science bimonthly 'Dristi' in Assamese. He has been the associate editor of Assam Science Society's popular science magazine 'Bijnan Jeuti' for eight years, and Chief editor of 'Assam Science Glossary' (1973), and 'Explanatory Science Dictionary' (1992) of Assam Science Society. □

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CSIR NEWS

International Conference on Business Information Technology Management — BIT WORLD 1998

MANAGEMENT of Information Technology (IT) by the business has evolved into a complex process comprising diverse incentives, multiplicities of dynamic capabilities and multiple dimensions. Issues on the management of IT within the business include policy dimensions on the national information infrastructure, IT education, social productivity, and information regarding social impacts and resource mobilization. IT within the business can not remain departmentalized Information System (IS). Contemporary IT management has to be an integral partner of the strategic issues regarding the Business Process Reengineering (BPR), the Enterprise Wide Resource Planning (ERP), and above all the process of learning in an organization. The IT strategy and the business strategy can not remain separate and distinct. These are the major observations made at the International Conference on Business Information Technology Management (BIT WORLD 1998), held

at Taj Hotel in New Delhi, during 25-27 February 1998.

The conference was organized by the National Institute of Science, Technology and Development Studies (NISTADS), New Delhi, in collaboration with Manchester Metropolitan University, UK, Cranfield University School of Management, UK, and Indian Institute of Management, Ahmedabad, in which over 45 experts in IT, BPR and ERP participated. Thirty-six plenary/invited papers were presented in 5 technical sessions. In addition, three keynote addresses were delivered. The publication entitled 'Business Information Technology Management: Closing the International Divide' containing the papers was also released.

Opening remarks for the conference were made by Gurpreet Dhilon of the Cranfield University School of Management, UK. This was followed by the first keynote address by Gordon B. Davis, President, Association of Information

Systems (AIS). He spoke about the Nature of academic field of information systems, Information systems as a worldwide academic field, Progress in becoming a worldwide community of scholars, and Progress with AIS as the worldwide umbrella for scholars in information systems. According to him, IS is a major organization function for adding value to various organization functions by providing specialized products and activities regarding: Acquisition, development and implementation of IS infrastructure; Acquisition, development and implementation of application systems; Operation of information infrastructure and systems; and Technology assessment of new and existing information systems.

In the first session, Sanjeev Phukan (USA) presented a paper on 'Creating the global information systems professional: Challenges for education'. According to him, the changes in IT including computers, communications and office automation have brought the potential of

global markets and global competition to the doorsteps of even the smallest companies. The business schools have yet to internationalize their curricula to any major extent. It appears that both the research and practice need to grow in this rapidly growing and critically important area. Another paper regarding the need to encourage computer literacy was presented by Michael Sherwood-Smith (Ireland) on the need to globalise the European Computer Driving Licence (ECDL) programme by promoting an International Computer Driving Licence (ECDL) programme using web-based training, automatic testing and enthusiastic government support initiatives.

The investigations on removing communication barriers with a transaction-oriented derivative of the extended World Wide Web Design Technique (eW3DT) were presented by Arto Scharl (Austria). He presented a document-oriented modelling framework by using eW3DT for the design of Web-based mass IS which allows the integration of all currently installed non-compatible systems (e.g. telephone, cable TV, computer networks and VSAT services), leading to economization of communication sector. The proposed method primarily focuses on business-to-consumer transactions. Complementary to approaches based on the entity-relationship model, eW3DT is intended to remove communication barriers between academic research, management, and the designers of mass IS. Together with an overview of available data and navigational object types, an electronic storefront has been presented as an example for this application of eW3DT to the real-world scenarios. In addition to seamless integration with database-oriented approaches,

future research will have to address the classification and modeling of dynamic systems behaviour and to provide meta objects for adaptive components, standardized user profiles and distributed models of trust. The paper 'Backyard and frontyard of industries in Delhi' was presented by Pradosh Nath (NISTADS). Two hundred enterprises were covered to evaluate the patterns of industrial organization among them. This study shows that industrial organization in and around Delhi is a long chain of supplier and buyer where family-based tiny units are the tailenders. Manufacturing activities are based on simpler technology, higher labour intensity and minimum specialized skill starting from the mother enterprise down the tail. Also, IT usage and information content is declining down the line (tail).

Vishanth Weerakkody (UK) presented his findings 'Exploiting business process and information systems reengineering (BP&ISR) in Sri Lanka'. BPR initiatives are aimed at reengineering the information systems that support the core business processes. The presented studies cover the process and IS reengineering work for the business areas — the payment process, and the job control process — for a leading mercantile organization, PML. The problems encountered for implementing these two business functions show that without the commitment of senior management to address the critical success factors, a BP&ISR project is doomed. Peter Kueng (Switzerland) dealt with the concept of supporting BPR through a Process Performance Measurement System (PPMS). According to him, the present performance measurement systems do not take into account non-financial aspects adequately, and that they are not

focussed upon the business process. It has been argued that the process reengineering should be part of a process management and therefore be supported by a PPMS. Thus, through the launch of a BPR project, a never-ending improvement process supported by PPMS should be put in place.

Simon Rogerson (UK) reviewed smart card technology for a number of typical applications from different countries. Some positive and negative social impact issues were identified. According to him, as with all advances in IT, it is difficult to forecast what might be achieved with smart cards. It will be useful to evaluate the examples of beneficial applications and consider strategies that might promote sensitive and acceptable development, implementation and regulation of smart card technology. The research findings presented by J. Christopher Westland (China) compare and contrast the information systems provided by the Shanghai Stock Exchange and the Moscow Stock Exchange, detailing the two systems that utilize widely divergent approaches to privatisation.

Seven papers were presented during the second session on the first day. Matthias Nicola (Germany), in his paper on wireless information systems in developing countries, presented a sample application of distributed health care system in Tanzania, and concluded that packet radio is presently quite attractive for use in developing countries because of its low costs. According to him, remarkable development of satellite systems, specially iridium-based, will soon provide sophisticated communication services. Iridium's main advantage over other systems is that its inter-satellite links will allow service in

developing countries without any terrestrial wireline infrastructure. More work has yet to be done regarding data protection and privacy in health care information systems in the developing countries.

The paper 'Health and safety in IT — An international education issue' was presented by Randhir M. Sharma (UK). The fieldwork reported in this paper, undertaken in UK and India, shows that the safety problems associated with the use of IT are being experienced internationally and that the education may provide the key to long-term solution by enabling IS designers to design and build computer-based IS which do not put the health and safety of their users at risk.

Studies on effective management of IT, reported by Janice M. Burn (Australia), were aimed at determining whether there are any significant differences in perspectives of IT and business managers with respect to strategic alignment. A general survey for the same, undertaken over a range of industries, indicates that the two perspectives are largely equivalent except for their overall perception of factors which contribute to success in strategic alignment by majority of organizations. The detailed case studies on the container terminal operators show very different patterns of alignment, suggesting that successful alignment of IT in industries, which are highly IT dependent, requires very different perspectives for both IT and business managers although these perspectives are still convergent within the organization.

The paper on IS/IT aspects of a co-operative society by Jiri Vorisek (Czech Republic) dealt with global trends in economical and information environment and their influ-

ence on strategic management of IS/IT and on the systems integration. He opined that the development of present economical environment is heading towards the co-operative society, putting new demands on economic subjects as well as on IS/IT. The changes will refer to IS strategic management by carrying out systems integration.

Non-linear and dysfunctional developmental path of information and communication technology (ICT) was discussed by G. Ronald Kaye (UK). He suggested that a non-linear path may exist for the development of ICT, reflecting late entrants having access directly to the later stages achieved in mature entrants, allowing late entrants to leapfrog earlier stages, offering increased choice in development path and creating non-linear pathway. According to him, the assumption of the neutrality of technology is flawed as it fails to recognize that technology develops in a cultural setting and consequently embodies that culture within its design. He cited the example of Japan, where one-third of all PCs are networked but the bulk of applications appear to be e-mail or some access to Internet replacing fax or copier. One contributing factor for it is the hierarchical corporate culture of Japan which discourages the flatter organizational style assumed in the presently available group-ware products like Lotus Notes or other application software.

Benita Cox (UK) presented a framework for the establishment of an electronic data interchange (EDI) strategy for countries that are still in the process of developing their EDI policies. The described CIC framework considers the importance of the Context (political, economic and social), the Infrastructure (tech-

nical requirements), and the Capacity to change (to accommodate dynamic requirements and technology developments) in developing a national EDI strategy. The framework has been implemented in Egypt for the EDI in Customs and Excise Authority. It has been brought out that a nation's capacity to change is an important determinant for the successful EDI implementation. Careful consideration needs to be given to the existing procedures and attitudes to the change. The paper presented by Brian Nicholson (UK) was related to exploring the impact of information and communication technologies with regard to globalization of education. The paper focusses attention on the notion of globalization, the role of education in global network, the problems for tacit knowledge and finally the arguments around cultural imperialism.

The second day of the conference started with a keynote address on 'Electronic Commerce (EC)' by Doug Vogel (Hong Kong). EC may be defined as electronic exchange of business information. According to him, few concepts have caught the attention of financial markets and business, news media, government bureaucrats and public at large, with as much sound and fury as electronic commerce. A new day has dawned on small and medium sized enterprises (SMEs) by it. EC will find applications for increased inter-organizational transaction efficiency regarding electronic handling of routine financial and order processing information. Regarding application between an organization and its customers, cost-effective advertisement, taking orders and facilitating customer payment will be made possible with it. EC will change the way we live and work as

surely as has the advent of telephone, jetplane and T.V.

The focus of the paper 'Information intensity: A new dimension to vendor development' by N. Mrinalini (NISTADS) was to map out various organizational arrangements between Maruti Udyog Ltd and its vendors. According to her, the to and fro information flow between the company and its vendors, and also amongst the vendors has resulted in a dynamic network structure, facilitating indigenization process in the company. The reflection of this information exchange process is seen at various levels like technological upgradation, skill development, quality improvement, design development capability, etc. In his paper on benchmarking information intensity across the industry, Parthasarathi Banerjee (NISTADS) put forward the view that business as a process has received new attention. According to him, a network or a business process does exist in all rigid industrial organization. S. Kanungo (India) presented his findings on CEO's influence on IT management aspects in Indian context. Preliminary analysis suggests that most of the CEOs in India are realists and have expectations that are far lower than the technological promises made by vendors. The CEOs display a significantly high level of sophistication in appreciating technology and management issues by being sensitive to interface issues regarding human resources, IT management, organizational culture and management of change. There appears to be a significant gap between top and middle management in terms how they view similar issues and in their ability to think through resolution frameworks. According to him, involving users in the IS/IT developmental process is

the responsibility of top management. But the involvement at the planning level may not be useful. The issues associated with integrating information technologies into established organizational systems must be understood clearly by the top management. Investment on IT involves some risk but is useful as a learning phase for every organization preparing for larger objectives.

Doug Vogel (Hong Kong) presented his views regarding EDI not becoming successful in places like Hong-Kong while the same has been very successful in Singapore. One reason, according to him, was that infrastructure had been developed in Singapore over the years while in Hong Kong, no government backing was provided. Biswa Sarathi Majumdar (India) presented a paper on IT-based improved management system for water resources schemes at the Khadakwasala irrigation system in Maharashtra and concluded that the practicing engineers need some time to change to this computer-aided system operation from the conventional system.

The studies presented by A.T. Wood-Harper (UK) examine the adoption of electronic data interchange (EDI) in the context of Malaysia. Preliminary findings of the study show that there is a slow uptake of EDI usage in Malaysia and that most of the adopting organizations are those in the government. These studies will provide insights in the role of an organization in the diffusion of EDI and help researchers understand the relationship between the benefits that organizations seek from an EDI technology and the strategy they attempt to accomplish with the technology. The studies will also provide important guidelines for EDI

implementation in Malaysia. Presenting his paper on developing organizational capabilities for effective assimilation of IT, Santosh S. Nair (India) said that the imminent need for organizational changes posed by globalization trends and the emerging economic scenario the world over, coupled with the ever increasing push by IT, could lead the organizations to unmanageable situations if the business requirements and technology potentials are not understood well. The careful adoption of IT plays a key role in successful change process. Effective incorporation of IT tools and products into business main stream would call for development of certain other organizational capabilities which would catalyze smoother and healthier acceptance of new technology. It may be seen that the factors such as IT education, top management awareness and healthy information culture are certain prerequisites for healthier adoption of new technologies, which, in turn, could help the organizations to manage successful IT-enabled business transformations. Efforts should therefore be focussed to nurture and enrich these capabilities to harmonize business interests with technology potential.

Dennis Dunn (UK) presented his findings on exploring the links between IS evaluation and organizational learning. He proposed a framework to gain an understanding of the relationship between IS evaluation and organizational learning based on case studies of post-implementation evaluation practice in UK. According to him, a more deliberate and concerted effort is required to spread the lessons learnt from IS evaluation as traditional modes of dissemination can act as barriers to learning and cultural change. The

promotion of an open reflective environment is essential to provide the correct climate for the learning to take place. Further work is needed to test the presented ideas and to develop the tool support for this framework. F.H. Gregory (UK) described the cultural problems encountered during a case study that applied SSM-LLM in the design of an Executive Information System for the newly demonopolised Hongkong Telecom. The SSM-LLM made possible the identification of system requirements but the method still has practical problems that need to be analyzed further.

Peter Blackeby (UK) reported findings on IT as the catalyst for business convergence. He described the benefits being achieved by Eagle Star Re, a reinsurance company based in London, as a result of substantial convergence in its UK operations. The parallel systems in operation for marine and non-marine areas of the company had to be converged. The business at Eagle Star Re appeared to have different set of practices and procedures in the parallel systems, which had to be converged adopting appropriate IT products. The project involved introduction of analytical approach to gain a sound understanding of business issues and challenges involved, demonstrating the potential benefits by adopting common solutions.

Investigations on the development of transnational information systems (TIS) were presented by P.A.H.M. Mantelaers (The Netherlands). The paper describes a multidisciplinary case study to gather empirical data about problems encountered during TIS development and management. The paper focuses on the new computerized transit system (NCTS) for countries in the European Union. The study

highlights TIS development in an empirical setting. The preliminary studies on four TIS cases showed similar traits during the development of each system. These findings may enable us to formulate guidelines and concepts to aid TIS development and management. Sandi Kirkham (UK) described the application of Soft Systems Methodology (SSM) for studying cancer services within the West Midlands area of UK involving a change of culture and organization within trusts. The project aims at bringing the IT and health professionals to a common understanding of and commitment to an informed organization with the help of SSM, and also facilitate the communication of best health-care practice across different organizations. The paper presented by Walter Skok (UK) dealt with management of IT within business. It takes into account the recent company, education and international issues and makes observations for possible actions. The paper also considers the background to managerial competence in this respect and also its current relevance in an attempt to achieve a closer congruence between the requirements of business and IS/IT for developing hybrid managers.

Santanu Roy (NISTADS) presented a paper on organizing information for planning and decision-making, based on the studies carried out on 31 CSIR laboratories. The study attempts to find out the nature and extent of qualitative differences existing in the functions being carried out by the personnel belonging to Scientific and Technical personnel in CSIR. Six categories of functions have been identified for the two groups of employees. These results map the laboratories in terms of these functions in two-dimensional space and provide the corporate managers and decision-makers at the CSIR level an invaluable input

for making policy decisions depending upon the strengths and weaknesses of the laboratories in different functional areas in terms of their scientific and technical manpower. The paper on third IS/IT paradigm shift and its impact on IS/IT professionals was presented by Andrew Korac Kakabadse (UK). According to him, the responsibility of the IS/IT system professional is no longer focussed on designing information systems, but instead on carefully directing the users to design their own systems. Changing the role of IS/IT, from support to a driver of organizational strategies, brings with it a need for a different set of skills and competency in the IS/IT profession. To meet the information processing needs of new global organization, IS/IT managers and their IS/IT staff need to develop new skills focussed on the business rather than technical processes.

The keynote address on 'Harnessing value from investments in IT — Indian experience' was delivered by Subhash Bhatnagar (IIM, Ahmedabad) at the start of the third day of the conference. He said that IT applications for automation in India are generally routine. Also, IT is not focussed to the social problems, e.g. IT could have made contribution in family planning programme in India by analyzing the family planning data using computers. According to him, for putting IT to potential usage, the organizations need to put greater effort in: Choosing applications; Managing the change process; Focus on business and not just on technology; Clarity in benefits to be derived from an application; Reengineering of business/management process; Auditing benefits from applications already implemented; and Managing the use of information. He cited the example of a success story of IT implementation for enterprise-wide solution by Hindustan Lever Ltd to manage the supply

chain comprising 20 factories, 70 vendors, 52 warehouses, 3000 resellers and 600,000 retailers. The aim was to measure service level to reseller item by item for enforcing efficiency and bringing down inventories as the company is to act under enormous competitive environment. He cited another example of application regarding banking sector for encashing cheques, where the process chain for encashing the cheque has remained the same. Thus, the advantages of computerization are not drawn fully as the process is not reengineered to improve customer service.

The studies on attitudes towards computers among Hong Kong's accountants were presented by Roger W. Harris (Malaysia). His results support hypothesized influences on attitudes from personality, product involvement, task characteristics and demographic variables. Mechanisms for promoting involvement and positive attitudes towards computers are critical for alleviating negativity and for full appreciation of the benefits of PC use.

The studies presented by Margaret Tan (Singapore) relate to critical success factors of EDI — Perspectives from TradeNet. The TradeNet, launched in 1989, links the private trading community to government agencies to process trade documents for cargo clearance. The advent of TradeNet has changed the trading community's mode of operations significantly. The electronic system of approvals has now become a new way of conducting business. TradeNet's encapsulation of more than 20 declaration forms into one electronic form, that could be automatically sent across all relevant government agents, has revolutionized the trade documentation process. EDI today is a one-step solution to total business needs. When EDI is fully implemented for

the various process flows using Internet technology, a total trade information management environment in which the electronic trading centres provide information repositories, the national networks provide local business to the reach to companies, and the global networks provide connections to the international community, trading becomes borderless.

Simon Rogerson (UK) focussed attention on identifying cultural differences in communication patterns that might apply in an international context. The study appears to suggest that body language and verbal communication techniques are an important aspect of human interaction processes that are differentiators in an international context. According to him, for the successful diffusion of communication technologies in the global market place, these issues need to be recognized in the design of technologies that support the communication task. Further studies are required combining the disciplines of experimental psychologists, ergonomists, and technologists to ensure that emerging communication technologies recognize and support these traits.

The findings reported by B.S. Vijayaraman (USA) provide considerable support to their conceptual framework of career success of IS professionals. Some of the characteristics of successful IS professionals identified in the studies are stable individual differences while others are more trainable. The stable individual differences, such as attitudes towards change, appropriate cognitive abilities, aggressiveness, problem seeking/solving abilities, and attitudes towards learning, can be used in counselling potential students into the IS programmes. Other characteristics that are trainable, such as technical skills set, systems thinking, communication skills and

understanding of organizations, can be used in IS curriculum development and in the assessment of IS students.

Yugi Masuda (Japan) presented his paper 'Information of the socio-economic systems in the global context'. According to him, a socio-economic system that will support continued development by recognizing the importance and diversity of the varied cultures in the individual nations and regions must be planned and built. The knowledge and IT are not limited to certain civilizations and are expanding globally. Supremacy in IT should not be used to establish information hegemony and vertical rankings of the rulers and the ruled. Instead, horizontal relationships should be built within the common information space. Global governance should be established this way for the stable and sustainable progress in global socio-economy. Takao Nuki (Japan) dealt with 'Earlier and faster — A new trend of Japan's production strategy'. He put forward the view that to compete in the global economy, Japan should have a strategy for overall manufacturing industries by faster creation of new products involving high technology, skill and design. Studies by Gurpreet Dhillon (UK) dealt with the dilemma that many emerging economies face with respect to the advent of networked organizations. It may seem that networked organizations and their use of local resources offer a viable option for the progress of a nation. But, a deeper analysis suggests that the mega corporations of the world are keen to exploit the competence of developing countries like India. It is the responsibility of the host country to determine the right mix of aspects involved in collaborative ventures. □

The Wankel Rotary Powered Hang Glider takes to the Air

THE maiden flight of what is probably the world's first Wankel rotary engine-powered hang glider took place on 26 February 1998, at the Jakkur airfield. With support from the AR&DB, a team from the National Aerospace Laboratories (NAL), Bangalore, has been working over the last couple of years to adapt an air-cooled Wankel engine for powering an indigenously designed and built single seater powered hang glider named 'Altair'. The aircraft was piloted by Dr B.R. Pai, the coordinator of the team. The flight confirmed the expected performance of the tiny 35 hp engine.

The Wankel engine has been on the horizon as a competitive solution to the conventional reciprocating engine over the last several decades but has yet to establish itself as a clear winner in a niche market. It has several promising features which have kept the interest alive in several research centres and industries and Altair's flight might well be seen as the light at the end of the tunnel. Wankel is now recognized as a good power plant for unmanned aerial vehicles in view of its superior power-to-weight ratio. The earlier problems of short seal-life have now been overcome and there is no conceivable reason why this engine can not be exploited for wider applications. Its initial applications are likely to be where its higher power-to-weight ratio and good specific fuel consumption give it an edge over reciprocating engines, e.g. light aircraft, unmanned air vehicles (UAVs) and helicopters.

The rigid and uncompromising requirements of certification for manned flight have so far proved to

be a hurdle in view of the cost involved in getting such certification.

Keeping that in view, the NAL team evaluated the possibility of applying the Wankel engine to a powered hang glider. This aircraft, in the 'microlight' or 'ultralight' category, does not require a certificated engine and can be flown in a manner that engine failure does not affect flight safety. It was felt that once the engine is proved on this class of aircraft, it would pave the way to develop fully certificated engines. The team picked the Norton 731 air-cooled engine for the initial application to a single-seater powered hang glider. This little engine designed for UAV applications weighs only 10 kg and develops a phenomenal 35 hp and has a specific fuel consumption much better than any other 2-stroke engine in its class and compares well with good four-stroke engines. For instance, a comparable 2-stroke engine would weigh about 2.5 times and have a fuel consumption about 50% higher. The main problem to be overcome for the intended application was that of adequate cooling of the rotor. The engine was originally designed for a high cooling air pressure available in a high speed drone aircraft but not in a low speed application. Therefore, a shaft driven fan development was undertaken by the project leader, Shri K. Sivasankaram. This proved to be quite tricky since the design called for a specific speed which was intermediate to radial and axial fans and about 5 builds had to be experimented with before adequate cooling was achieved in rig tests. Moreover, ingenious baffle plates were introduced to provide adequate cooling of the rotor and engine casing. Apart from this, a 3:1 speed reduction unit and auxiliary systems for engine lubrication, silencing and starting were de-

veloped in the Propulsion Division workshop of NAL.

Further flight tests are planned to validate the performance of the system and to make the engine more robust for the application to microlight aircraft. Under a project sponsored by the Aeronautical Development Establishment, a feasibility study for manufacture and producibility of Wankel engines has been carried out. It would be feasible to bring Wankel engines into the larger market segment covering UAVs and possibly microlight aircraft. □

Solid State Room Temperature Gas Sensor

GAS sensing properties of a family of materials, which detect selectively NH_3 and NO_x gases, in the temperature range of 0°-40°C has been studied at Central Electronics Engineering Research Institute (CEERI), Pilani. These materials are highly sensitive to these gases and are insensitive to other gas species. This property is being used to study a new type of device, known as Capacitively-Coupled Field Effect Transistor (CCFET), for an Si-based solid state gas sensor which can be operated at normal room temperatures.

The device consists of a capacitor with an air-gap and a FET. One plate of the capacitor is a gas sensitive film and the other one forms a reference electrode and is connected to the FET gate. The operating principle is based on the change in work function of the gas sensitive surface due to gas adsorption. This is measured as change in gate applied voltage of the FET. The measurements show that the non-amplified signal is more than 10 mV for 5 ppm of NH_3 . Typical rise-time of 24 s and fall-time of 250 s are obtained. □

Hybrid PIN-FET Preamplifier

MODERN optical fibre telecommunication systems require high-speed optical transmitters and receivers which are capable of operating at long wavelengths (1.3 and 1.55 μ m). These subsystems play very crucial role and are vital to the performance of the optical networks. In particular, the optical receivers are used to translate the optically encoded signal into an electrical one in order to retrieve the original information.

Optoelectronic Device Group at the Central Electronics Engineering Research Institute (CEERI), Pilani, with the financial support from Pho-

tonic Development Council, Department of Electronics, New Delhi, is involved in developing technology for compound semiconductor-based optoelectronic devices and integrated circuit receivers suitable for application in high data rate optical communication systems.

Hybrid PIN-FET preamplifier module consists of low capacitance front illuminated planar in-house fabricated InGaAs/InP PIN detector and a hybrid transimpedance amplifier. The transimpedance approach for the amplifier design is followed due to its excellent dynamic range, ease of implementation and self biasing property. Also, it does not re-

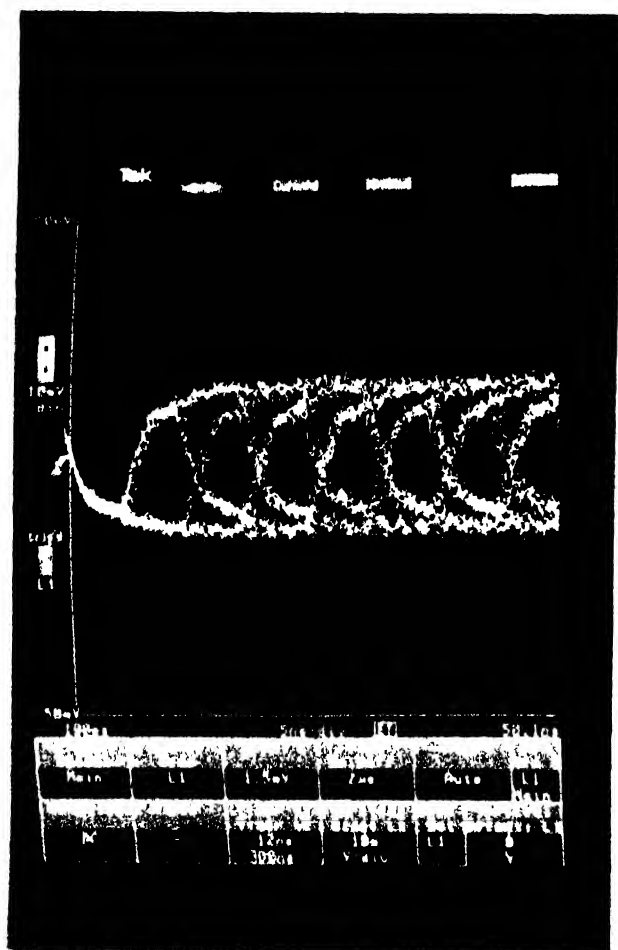
quire any equalization. Optical input is provided to the module through a FC/PC connectorized multi-mode fibre pig-tail. InGaAs/InP PIN detector with operating optical wavelength range from 1100 nm to 1600 nm is die-mounted and wire-bonded on a patterned alumina submount. Active alignment technique is followed for the alignment of optical fibre and PIN detector. PIN-FET preamplifier module operates at bias voltages of ± 5 volts. Both 155.52 Mbps and 8.448 Mbps hybrid PIN-FET receiver modules, developed at CEERI, and tested at C-DOT, New Delhi, have the following specifications:

Parameter	155.52 Mbps Module	8.448 Mbps Module
Bandwidth Minimum	110 MHz	10 MHz
Receiver Sensitivity	-30 dBm	-42 dBm
Receiver Saturation Level	-10 dBm	-17 dBm
Dynamic Range	20 dB	23 dB
Effective Transimpedance	8 K Ω	80K Ω
Bit Error Rate	Less Than 1 in 10 ⁸	Less Than 1 in 10 ⁹

□

Gain & Phase-matched Miniature Helix TWT for Phased Array Radar

THE latest two prototypes of mini TWT GMT-11 and GMT-12 developed by the Central Electronics Engineering Research Institute (CEERI), Pilani, gave the required performance under pulsed condition, i.e. 40W (minimum) power and 40 dB (minimum) gain throughout the C-X-Ku band. At the mid of the band, power was found to be even more than 65W. The development of broadband miniature Helix TWT finds application in ship borne phased array radar system. The grant for the project has been provided by Defence Electronics Research Laboratory (DERL), Hyderabad, and the TWT is being developed in collaboration with M/s Bharat Electronics (BE), Bangalore. Further work to operate the device under CW operation and to attain tube-to-tube matching in terms of gain and phase characteristics has to be carried out. Efforts have already been initiated to transfer the technology to BE. To start with, drawings of all the components/sub-assemblies and some of the process manuals relating to the fabrication of the TWT have been handed over to BE and in some cases, its feedback has been received. □



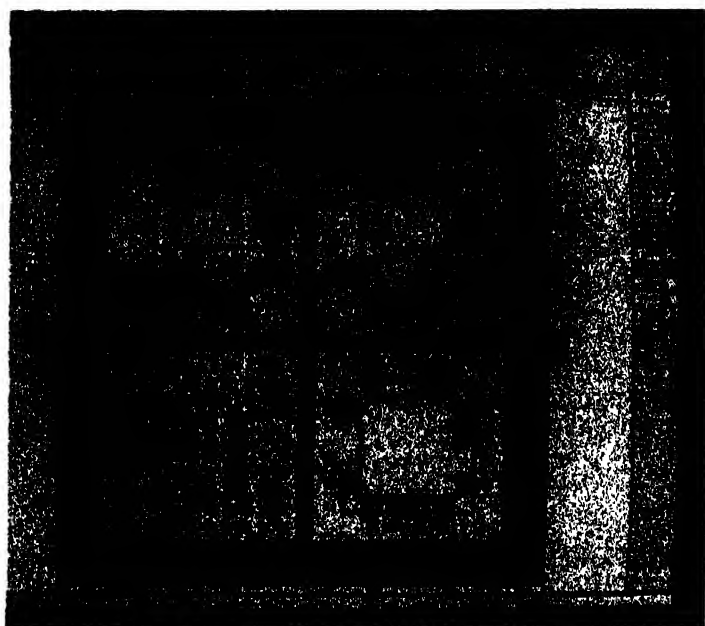
Hybrid PIN-FET preamplifier module eye diagram at 155.52 Mbps data rate operation

CD4000 Equivalent Circuits

THE Central Electronics Engineering Research Institute (CEERI), Pilani, has undertaken the development of CD4000 equivalent circuits in consultation with ISRO, Bangalore, for validating the three micron n-well CMOS process technology developed earlier. These chips were designed in a multichip mode. The multichip die contains test structures for process characterization in one zone and three other zones for chip functionality equivalent to CD4001B and

CD4050 in the design variation for input electrostatic discharge (ESD) gate protection using diode and SCR circuitry. The complete fabrication of these devices involves 10 level photolithography, 5 implantations, 3 chemical vapour depositions, 5 reactive-ion/plasma etching steps, 10 high temperature processes including n-well, active area definition, gate oxidation, and single level metallization. The multichip die size is $5.6 \times 5.6 \text{ mm}^2$.

The fabricated chips have been encapsulated in a 16-lead dual-in-line ceramic package and the functionality tested. The packaged devices have been found to be fully functional and meet the desired specifications except for the quiescent current of the device. □



CD 4000 Equivalent circuits

Quick Determination of Withaferin-A from *Withania somnifera*

WITHANIA SOMNIFERA is one of the most valuable medicinal herbs used in the treatment of many ailments in Indian system of medicines. Withaferin-A, an unsaturated steroidal lactone isolated from the leaves of this plant is the most important withanolide. It has remarkable bac-

teriostatic, antitumour, antiarthritic and antiinflammatory activities. Isolation of withaferin-A has thus created a great interest among scientists and intensive research on *W. somnifera* and other species of the same family is being pursued.

Owing to its simplicity, accuracy and low cost, TLC densitometry

method is utilized more frequently than HPLC in the screening of medicinal plants.

Experiments were conducted at the Central Institute of Medicinal and Aromatic Plants (CIMAP), Lucknow, on the use of dual wavelength TLC densitometry for withaferin-A estimation in *W. somnifera* employing a Desaga model CD-50 densitometer equipped with a dual wavelength thin layer chromatography scanner and data recorder along with precoated silica gel plates 60-F245 ($220 \times 20 \text{ cm}$) with a layer thickness of 0.25 mm (Merck). Withaferin-A was isolated from the leaves of *W. somnifera* grown at CIMAP.

Methanol extracted crude withanolide from different plant parts viz. leaves, root, stem, seed and persistent calyx was dissolved in 0.5 ml chloroform and a known amount of it was cochromatographed with standard withaferin-A on a TLC silica gel 60-F254 plate using chloroform-methanol (95:5) as developing solvent. Spots were visualized as in the case of preparation of standard solution. The quantitative estimation of withaferin-A was performed using the calibration graph. The graph was constructed by plotting concentration versus spot area of the compound which was linear in the range of 2-25 μg of the compound.

The average recovery rate of the compound in leaf samples was about 96%. Scientists are anticipating that this method can be used for a large scale sample screening in crop improvement programme. Fifteen samples can be analyzed on a $20 \times 20 \text{ cm}$ TLC plate in about 2 h after extraction of the samples by using this method. □

Processes Licensed, Patents Filed and Sponsored/Consultancy Projects taken up by CECRI during January-February 98

DETAILS regarding the processes licensed, patents filed and sponsored/consultancy projects taken up recently at the Central Electrochemical Research Institute (CECRI), Karaikudi, are given below:

Processes Licensed

- i) Cement polymer composite coating of reinforcing steel to M/s Narindra Coatings (P) Ltd, Mumbai [Lumpsum Premium(LP) Rs 500,000; Recurring Royalty (RR) 2.5%.]
- ii) Diamond powder incorporated nickel metal matrix composite to M/s Dhariwal Consultants & Contractors P. Ltd, Kotta [LP Rs 40,000 (Rs 20,000 Demonstration Charges)]
- iii) Recovery of lead from battery waste to M/s Nile Ltd, Hyderabad [LP Rs 85,000]

Patents Filed

- i) 2624/D/96: A formulation useful for non-etching chromium plating — R.M. Krishnan, S. Sreeveeraraghavan, Shoba Jayakrishnan and R. Sekar.
- ii) 1716/D/97 : Formulation useful for chemical stripping of gold from different substrates — R.M. Krishnan, S. Sreeveeraraghavan, Shoba Jayakrishnan and R. Sekar.
- iii) 377/D/98: Improvement in or relating to pulse anodising of aluminium and its alloys using sulphamic acid electrolyte — D. Kanakaraj, S. Vincent, J. Kennedy, V.L. Narasimham and Y. Mahadeva Iyer.

Sponsored projects taken up

- i) Electrochemical joining of dissimilar metals (Department of space, Bangalore, Rs 150,000)
- ii) Diamond powder incorporated nickel matrix composite coatings (M/s Dhariwal Consultants Contractors P. Ltd, Kotta, Rs 50,000)
- iii) Recovery of lead from spent lead acid batteries (Ministry of Environment and Forests, New Delhi, Rs 640,000).

Consultancy projects taken up

Carrying out corrosion survey and assessing the condition of steel and concrete structures in the area of PIG casting machines and coke oven plant (Visakapatinam Steel Plant, Visakapatinam, Rs 364,000).

Rose and Gladiolus Show at NBRI

THE National Botanical Research Institute (NBRI), Lucknow, organized the Annual Rose and Gladiolus Show on 17-18 January 1998 at its Central Lawn. The show attracted a total of 510 entries belonging to 64 competitors from Lucknow and outstation. Otherwise a feast of colours and wafts of heady fragrance, the exhibits had appealing themes like, 'Jeevan ke rang anek', 'Tum to tha-hare pardeshi', 'Every yellow is not gold', 'Umang madhumas ki', 'Rang laal hai Lal Bahadur ka', 'Tribute to Mother Terasa', 'Phoolon ki patti se kat sakta hai heere ka jigar', 'Shed love not blood', 'Speak my language', 'Peace, harmony and unity' and 'Dil to pagal hai'.

This year, the prize for best red rose of the show 'Christian Lanson' was given to Smt Nalini Sharma of HAL, Korwa; best yellow rose of the show 'Golden Jubilee', to Karya Shala Chawani Parshed; best Indian bred H.T. rose of the show 'Siddhartha', to Shri S.P. Sharma of HAL, Korwa; best stripped/streaked rose of the show 'Sahashradhara' to HAL, Korwa; best fragrant rose of the show 'Charles Mallerin' to HAL, Lucknow; best bicoloured/blended rose of the show 'Alabama' to Headquarter, Central Command; best red rose of the show 'Mr Lincoln' to CIMAP; and best gladiolus spike of the show 'Pricillia' to Km. Poonam Singh.

The 25 running cups/shields/trophies went to the following competitors: The HAL, Lucknow Division, Lucknow stole the show this year also by lifting as many as eight running challenge cups/shields/trophies, namely, (1) Commissioner's Running Challenge Cup for the highest score in class-A, (2), Movie Mughals Running Challenge Cup for

the highest score in class-B, (3) Ch. Akbar Hussain Memorial Running Challenge Trophy for the best fragrant H.T. Rose of the Show in class E-3, (4) Lt. Col. V.R. Mohan Challenge Cup for the highest score in class E-6 to E-15, (5) Bonanza Decorator's Running Challenge Cup for the highest score in the potted roses in class-H, (6) Baljit Singh Memorial Challenge Cup for the best potted floribunda rose in class I, (7) H.C. Gupta Memorial Challenge Trophy for the best collection of 12 stems of different floribunda roses in class L and (8) Bonanza Decorator's Running Shield for the highest score in the show. HAL Korwa, Amethi, lifted four running challenge cups/shields/trophies namely (1) Smt. Usha Kacker Memorial Running Challenge Cup for the best collection of Indian bred three stems of different roses in class D-5; (2) Hirday Prasad Tiwary Running Challenge Shield for the best H.T. striped/streaked coloured rose of the show in class E-4; (3) Motor Sales Running Challenge Shield for best collection of 12 specimens blooms of different varieties of H.T. Roses in

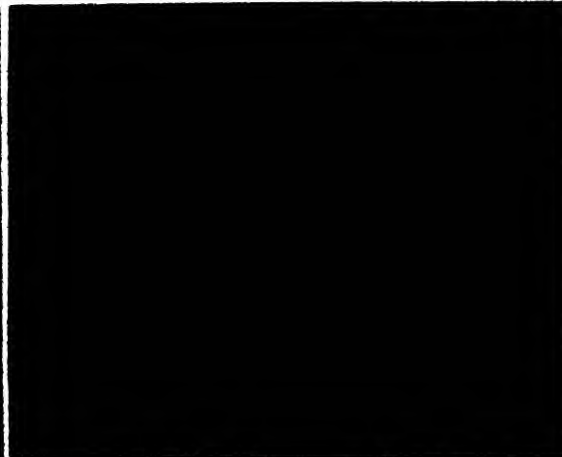
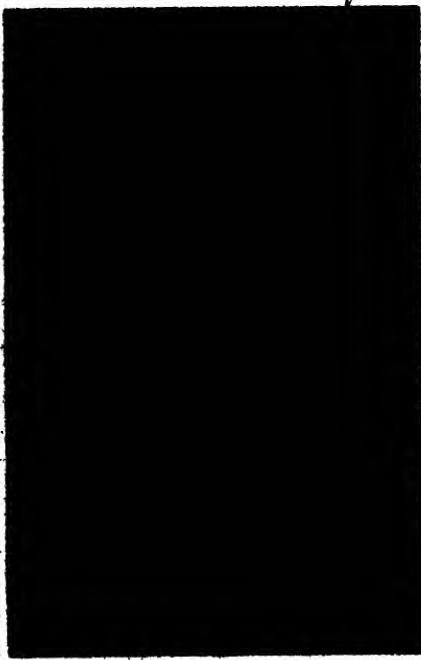
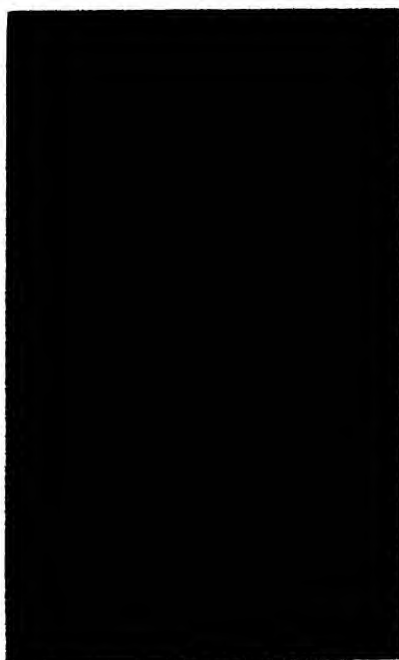


Dr S.C. Sharma describing the achievements of NBRI in the area of floriculture to Prof. Mahendra Bhandari and Smt Bhandari at the Rose and Gladiolus Show

class-K; (4) Sir Padampat Singhania Memorial Running Challenge Trophy for the best collection of 27 specimens blooms of different varieties of H.T. roses in class N.

Army Commander Challenge Cup for the best collection of 12 gladiolus spikes of different varieties in class Q and HAL (Lucknow Divi-

sion) Running Challenge Trophy for the best collection of gladiolus spikes in floral trade in class R were lifted by General Manager, Hotel Clarks Avadh, Lucknow. Shri S.P. Sharma, General Manager, HAL, Korwa, lifted Commissioner's Running Challenge Cup for the highest score in class-C and Raja Bhadri Running Challenge Shield for the



Best gladiolus spike of the show 'Priscilla'; Best red rose of the show 'Christian Lanson' and Best yellow rose of the show 'Golden Jubilee'

best Indian Bred H.T. Rose in Section D-1.

Shri S.C. Gulati, General Manager, HAL, Korwa, lifted Ch. Muzaffaruddin Memorial Running Challenge Trophy for the highest score in class C (C-12 to C-14) for the fragrant roses. Percy-Lancaster Challenge Cup for the best Red Rose of the Show in class E-I was lifted by Dr Sushil Kumar, Director, CIMAP, Headquarter, Central Command, Lucknow, won R.V. Sitholey Memorial Running Challenge Cup for the best bicoloured rose of the show in class E-2. Sulabh Tewari Memorial Running Challenge Cup for the best H.T. Yellow Rose of the Show in class E-5 went to Workshop, Cantonment Road, Lucknow. Smt. Nalini Sharma, HAL, Korwa, lifted Mall Nursery Running Challenge Cup for the best rose of the show in class G. Km. Poonam Singh of Lucknow won Syed Gulam Abbas Kazmi Running Challenge Shield for the best gladiolus spike of the show in class O. Jugal Kishore Jewellers Running Challenge Trophy for the highest score in class F (F-6 to F-16) was lifted by Smt A.A. Tejam, HAL, Korwa, Sultanpur. Motor Sales Running Challenge Cup for the best collection of 8 gladiolus spikes of different varieties in class J went to Taj Mahal Hotel, Lucknow.

A very eye-catching section of the show was that of gladioli where a large number of colourful varieties were on display. NBRI has evolved 30 gladiolus cultivars suitable for cultivation in Gangetic Plains. Most of these were on display. The institute also displayed its choicest collection of exotic varieties of Indian bred roses. The new cultivars of roses evolved by gamma-ray induced somatic mutation like 'Tangerine Contempo', 'Yellow Contempo', 'Sharda', 'Sukumari', 'Twinkle' and 'Light Pink Prize' were displayed.

Dr B.P. Singh, Deputy Director, NBRI, while welcoming the Chief Guest, Prof. Mahendra Bhandari, Director, SGPGIMS, Lucknow, highlighted the R&D efforts of the institute, in evolving several new varieties and their release for nursery

trade. Prof. Bhandari in his address lauded the efforts of NBRI in this direction. Smt Bhandari gave away the running challenge cups, shields and trophies, and other prizes to the successful competitors. □

CSIO to play key role in Revamping of Technician Education

WITH advancements in technology and arrival of multinational companies in the country, the industrial scenario has undergone a significant change. Technically skilled manpower — the product of polytechnics — needs to be trained accordingly and hence there is the requirement of revamping technician education in India.

An AICTE Committee Meet on Revamping of Technician Education was held at the Central Scientific Instruments Organisation (CSIO), Chandigarh, on 11 December 1997. It was attended by 32 delegates from industry, AICTE, academic and R&D institutions from all over the country.

Prof. S. Mohan, Director, CSIO, welcomed the Chief-guest, Prof. S. Rame Gowda, Chairman, All India Council for Technical Education (AICTE), and delegates, and explained the importance of the workshop and its accruable benefits to industry, hospitals, defence and the society. He touched upon the training techniques being adopted at the Indo-Swiss Training Centre (ISTC), Chandigarh, and employment potential of its students in India and abroad. An MoU is going to be signed between CSIO (CSIR) and Government of Sikkim, for setting up a similar training centre in Sikkim, he informed.



Meet on 'Revamping of Technician Education' in progress

Prof. Rame Gowda deliberated on sharpening the technical education in India and providing more practical- oriented and skill-based training in polytechnics so that their products are more useful to the industry and service sector.

Introducing appropriate methodologies of training simultaneously in large number of existing polytechnics is a monumental task, he said. So, AICTE is contemplating of choosing 3-4 polytechnics in each state which could be granted autonomy and asked to reorient themselves to provide need-based training. This scheme has to be implemented w.e.f. July/Aug 1998. The same technique could be worked out for other institutions in a steady manner. He appreciated training methodologies being followed at Indo- Swiss Training Centre, Chandigarh. This institute could serve as a model or nodal centre for re-orienting other polytechnics, he said. Centres like Murugappa Polytechnic, Chennai, and NTT, Bangalore, can also serve as good examples in addition to ISTC, he pointed out.

Prof. A. Kalanidhi, Adviser, AICTE, expressed that the diploma holders who have the lurking will of acquiring higher education should be allowed to do so along with their personal development and growth.

Prof. K.S. Hegde, Chairman, National Board of Accreditation, AICTE, suggested that need-based courses in non-conventional disciplines like Fisheries, Water Management, Textiles, etc, could be offered, to meet the needs of local areas.

Dr G. Vaithilingam, Principal, Murugappa Polytechnic, Chennai, emphasized the need of training the staff and developing infrastructural facilities for this revamping process.

Shri H.S. Anand from Telephone Cables Ltd, Mohali, stressed that apprenticeship should be a part of the curriculum of technician education.

A committee of experts, under the chairmanship of Dr G. Vaithilingam, was asked to consider all these aspects and submit its report to AICTE within two weeks.

Shri P.S. Malhotra, Principal, Indo-Swiss Training Centre, Chandigarh, proposed a vote of thanks. □

CMRI sets up a Laboratory for Testing of Footweares for Miners

THE Central Mining Research Institute (CMRI), Dhanbad, has set up a modern footwear testing laboratory with the latest equipment to carry out all the tests on the safety rubber canvas

boots/shoes (for miners) and their components. The tests are mainly conducted as per IS : 3976 - 1992 to ensure proper performance and durability. The laboratory also offers facilities for assessment of the content of polymer, zinc oxide and carbon black in the sole and heel of the boots/shoes by chemical tests using thermo gravimetric analyzer (TGA) and other important tests as per the additional tests requirements of DGMS covered by about 15 relevant IS specifications and ISO 9000 standards.

The comprehensive tests require about a month to complete. In order to shorten the testing time, a committee comprising CMRI, DGMS and CIL has suggested the above essential tests.

The facility for determination of relative density, hardness, flexing resistance, polymer content, etc., using TGA has also been created in the laboratory. □

TRAINING PROGRAMMES

Skill-cum-Technology Upgradation Programme on Modernization of Indian Foundries

THE National Metallurgical Laboratory (NML), Jamshedpur, in association with CSIR-Polytechnology Transfer Centre, Hyderabad, and District Industries Centre, Vijayawada, organized a two-day workshop on Skill-cum-Technology Upgradation Programme (STUP) on 'Modernization of Indian Foundries' at Vijayawada during 18-19 December 1997. The programme was sponsored by Small

Tests suggested by CMRI, DGMS and CIL		
Tests	Standards	etc.
Upper measurement, binding material, stitching and breaking test, etc.	IS : 2437 - 1983 and IS : 1954 - 1969	
Leakage test	IS : 2437 - 1983 and IS : 1969 - 1983	
Resistance to material of rubberized fabric	IS : 2437 - 1983	
Resistance to chemical tests	IS : 2437 - 1983 (Part I & II)	
Resistance to heat (Type I & II)	IS : 2437 - 1983 (Part I & II)	
Resistance to mechanical components	IS : 2437 - 1983 (Part I & II)	
Resistance to abrasion (Type I & II)	IS : 2437 - 1983 (Part I & II)	
Resistance to impact (Type I & II)	IS : 2437 - 1983 (Part I & II)	

Industries Development Bank of India (SIDBI) and Industries & Commerce Department, Government of Andhra Pradesh. The programme was inaugurated by Prof. P. Ramachandra Rao, Director, NML, and presided over by Shri G. Rajasekharaiah, General Manager, District Industries Centre, Vijayawada. Shri G.A. Reddy, Project Officer, CSIR-PTC, Hyderabad, welcomed the gathering and explained about the activities of the PTC. Dr C.S. Sivaramakrishnan, Scientist, NML, explained about the programme and Smt K. Chatterjee, Scientist, NML, spoke about the expertise of NML in various disciplines and also the facilities available for the foundry and other type of industries. Shri N.C. Harshavardhan, Scientist & Programme Co-ordinator, proposed a vote of thanks. More than 30 representatives of foundry industries from Krishna and neigh-

bouring districts in Andhra Pradesh participated in the workshop.

In his inaugural address, Prof. Ramachandra Rao highlighted the activities of NML, especially pertaining to foundries and called upon the entrepreneurs of Vijayawada to utilize the expertise of NML for modernization of their units, particularly in view of the globalization and liberalization of economy. He pointed out that India is fast emerging as an important global player in the foundry sector and multinational organizations have been showing interest to set up foundry industries in the country. He urged the Indian foundry industries to produce and export better quality products adopting latest technology.

The inaugural function was followed by four technical sessions in which the following topics were covered by the NML scientists and consultants with relevant experience of the foundry and forging industries: Cupola Melting Practices &

Allied Furnaces, Metallurgy of Cast Iron & Inoculations, Production of Cast Iron & Steel Castings, Advanced Moulding Practices and Moulding Materials, Technology Update-Moulding, Melting & Heat Treatment, Quality Control Steps Towards ISO, Pollution in Melting Units, etc. The programme witnessed a good interaction and lively discussion among participants, scientists and the consultants on various problems of the foundries. □

Production of Glazed Roofing Tiles

HERE is a major concentration of clay roof tiles units in different states of the country, which have been producing traditional types of unglazed roofing and decorative facing tiles since a few decades. The life and performance of these products are quite poor and the units are becoming less economical because of low productivity, availability of different and newer types of alternative roofing materials, and shrinking market.

The roofing tiles are directly exposed to the severity of environment. The protective layer of ceramic glaze, if applied on the roof tiles, would protect them from weathering agents like wind, dust, rain, fungus, etc., and enhance the life of tiles. In addition, the overall mechanical strength of glazed roof tiles increases by 20 to 25% which further imparts durability to the tiles.

The project involved assessment of quality of the existing products through the study of various parameters such as water absorption, apparent porosity, bulk density and thermal expansion as well as development of suitable low-temperature



Prof. P. Ramachandra Rao, Director, NML, delivering the inaugural address at Skill-cum-Technology Upgradation Programme on Modernization of Foundries. Seated on the dais (from left) are: Shri G.A. Reddy, PO, PTC-Hyderabad; Shri G. Rajasekharaiah, GM, DIC, Vijayawada; Smt K. Chatterjee, and Dr C.S. Sivaramakrishnan, Scientists, NML; and Shri N. C. Harshavardhan, Scientist, PTC-Hyderabad



Participants undergoing training during the training programme on 'Production of Glazed Roofing Tiles'

frits, transparent and coloured glossy and matt glazes and then optimization of their properties.

The unglazed roof & decorative facing tiles manufactured in the different states are fired in the range of 900°- 1000°C and frits and glazes intended to be used for these products should also mature at about the same temperature. The development of such type of glazes necessitates the use of low-temperature frits.

In view of the limitation in keeping the tile body constant and the surface of the roof tiles on which glaze is to be applied being rough, uneven, full of pinholes, cracks and lime spots coupled with non-uniformity of water absorption, it is quite essential to achieve optimum fluidity and maturity of the glaze at low temperature for smooth, glossy and defect-free glazed surface. Suitable low-melting borosilicate frits and glossy as well as matt glazes maturing at about 1000°C were developed as per the requirements.

To make industry aware of this technology development, the Naroda Centre of CGCRI organized

under the sponsorship of Small Industries Development Bank of India (SIDBI), Ahmedabad, a 5-day training-cum-demonstration programme on 'Production of Glazed Roofing Tiles' during 5-9 January. The one-week programme comprised theoretical lectures and practical demonstrations covering the following aspects: technological status of roof tiles industries in India and abroad, basic raw materials and their characteristics; tile body preparation and manufacture; making of frits and glazes; application and firing of glazes.

The glazed roof tiles fired at 1000°C with one hour dwelling time at the peak temperature in glossy and matt glazes were found to be of excellent quality with increased mechanical strength. These were attractive and free from defects. Further, no expensive raw materials were used for the development of frits glazes.

Eight participants — six promotion officers of SISI situated in different parts of the country and one each from two SSI units in Gujarat — attended the programme. The

participants appreciated the in-depth training as well as demonstrations imparted during the programme. They also expressed their happiness over the exhaustive and elaborate technological document provided to them. □

HONOURS & AWARDS

Dr P. Ratnasamy and Dr A.V. Ramaswamy

In order to promote regional cooperation in the area of catalysis in the Indo-Pacific region, the Indo-Pacific Catalysis Association (IPCA) was formed in 1996 with Prof. David Trimm of the University of New South Wales, Australia, as its President. The first symposium of IPCA (IPCAT-1) was organized by Prof. Cyril O'Connor of University of Cape Town at Cape Town, South Africa, during 26-28 January 1998. It was attended by about 160 delegates from various countries in Africa and Asia. A strong Indian delegation consisting of 18 scientists from different institutes in India including IICT, IIP, NCL, CFRI, RRL (Thiruvananthapuram), IIT-Madras and United Catalyst of India, Ltd, Cochin, participated in the above symposium.

During this meeting, it was decided that the second symposium, IPCAT-2, will be held at National Chemical Laboratory, Pune, in January 2001. Dr P. Ratnasamy, Director, National Chemical Laboratory (NCL), was elected as President and Dr A.V. Ramaswamy, Head, Catalysis & Inorganic Chemistry Division, NCL, as Secretary of IPCA.

From the Indian Institute of Chemical Technology (IICT), Hyderabad, Dr S. Narayanan, Scientist, led a three-member team with Dr B.

The
OCEAN
Heritage for
the Future

1998 - International Year of the Ocean

An Appeal

1998 is, for the oceanographic community, a year of special significance as the United Nations has declared it the International Year of the Ocean. Significant, because of the efforts that are being made, to create a global awareness about the oceans - our heritage for the future. This domain needs special attention and care, if mankind is to survive and prosper and it is in this context that 1998 should become a year of special significance to all of us, not only to oceanographers but also to all others in the marine sector.

India is a peninsular country, surrounded by seas on three sides, covering an area larger than 3 million sq. km, larger than its land area, and it is these seas that have served our resource needs, as a medium of cultural evolution and in sustaining life on Earth. The capacity of the oceans is huge in terms of heat transfer, recycling of greenhouse gases, absorbing pollutants etc., but even this large capacity is being stressed and tested almost beyond its ability to recover.

Let us today commit ourselves to play a responsible role in the judicious use of our ocean resources and to protect it adequately. After all, we hold this wealth in mere stewardship, for future generations.

Ehrlich Desa
Director,
National Institute of Oceanography, Goa



Mahipal Reddy and Dr V. Vishwanathan as the other two members, to the IPCAT-1.

An active interaction between IICT and University of Cape Town, Catalysis Research Unit, has been proposed during a special discussion meeting between Dr S. Narayanan and Prof. Cyril O'Connor.

Dr S. Narayanan

DR S. Narayanan, Scientist, Catalysis Division and Head, Education and Training Division of Indian Institute of Chemical Technology (IICT), Hyderabad, has been awarded the

prestigious Royal Society of Chemistry, London's 'Journals Grants for International Authors' in recognition



of his scientific contributions to Royal Society of Chemistry Journals. This award entitles him to visit several catalysis laboratories in UK,

France and The Netherlands, to deliver lectures and forge collaboration in his area of research interest.

Ms V. Sorna Gowri

MS V. Sorna Gowri, Senior Research Fellow, Regional Research Laboratory, Bhopal, has been given the ISCA Young Scientist Award at the 85th Indian Science Congress held at Hyderabad during 3-7 January 1998, for her work on 'Development of Productive Coating for Bamboo from Agro-based Waste Materials'. □

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CSIR NEWS

A New Process for Utilization of Banana Plants for Production of Fibres

IN a major grant-in-aid project assigned by the Directorate of Industries, Government of Arunachal Pradesh, the Regional Research Laboratory (RRL), Jorhat, carried out studies on the utilization of wild banana plants, abundantly available in India, for producing fibres and other useful materials. The main objective of the project was to develop an appropriate technology to extract fibres from the banana sheaths and then to convert the fibres into twines and fabrics in conventional jute processing machinery, apart from producing fibres

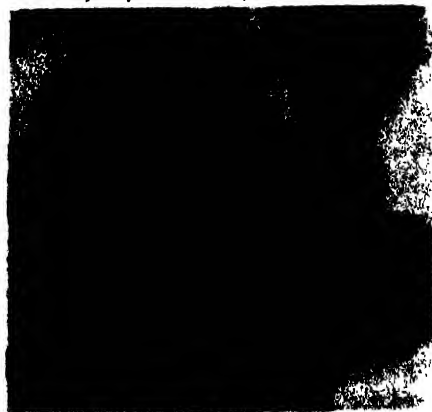
suitable for making eco-friendly products like carpets, doormats, bags, flower vases, table mats, purses, flower baskets, wall hangings, shopping bags, etc.

Vast areas in the forests of NE states, mainly in Arunachal Pradesh, are covered with wild banana plants. Being perennial in nature, the plants grow from rhizomes and bear fruit later, decompose gradually and remain as forest waste. The wild banana plants do not bear edible fruits. In the interior places of Arunachal Pradesh, villagers use the

banana sheaths and leaves for roofing purpose. The activities carried out at RRL, Jorhat, have generated interest in the north-eastern states and in the neighbouring countries. Sri Lanka has already requested RRL, Jorhat, to extend technical assistance to develop industries based on banana fibre in Sri Lanka and to impart training to entrepreneurs. □

Oleanolic acid from American ginseng acts as an insect anti-feedant

AMERICAN ginseng (*Panax quinquefolium*) is indigenous to USA. The plant has been successfully introduced in India in Jammu and Kashmir by the Central Institute of Medicinal and Aromatic Plants (CIMAP), Lucknow. The roots of *P. quinquefolium* are also used as drug material. Ginseng-based drugs are known to increase the body resistance against a num-



Twine from banana fibres(left) and Rope from banana fibres

ber of diseases. In addition to several genins, the hydrolysis of the saponins yield oleanolic acid as the major constituent. Oleanolic acid has been reported to possess hepatoprotective, antitumour, antiulcer, antiinflammatory, hypoglycaemic, antihyperlipidaemic and antimicrobial properties.

Experiments conducted at CIMAP have shown 98.75, 98.75, 43.61, 46.16, 16.81, 6.78% feeding deterrence for *Spilosoma obliqua* and 97.26, 93.74, 70.29, 54.37, 22.61, 8.43% for *Spodoptera litura* at the concentrations of 3000, 1500, 750, 400, 200, 100 ppm, respectively. These insectpests are polyphagous and destroy several cash crops including castor, mung, groundnut, soyabean and *Cajanus cajan* (arahar). Apart from this, *S. obliqua* destroys *Mentha* and *Coleus* crops too. Oleanolic acid commonly found in several other plants too, has great potential as insect antifeedant. It is envisaged that such studies will augment R&D in the area of crop protection using bioactive substances. □

Rapid *in vitro* Generation of Molecular Variation in *Mentha arvensis*

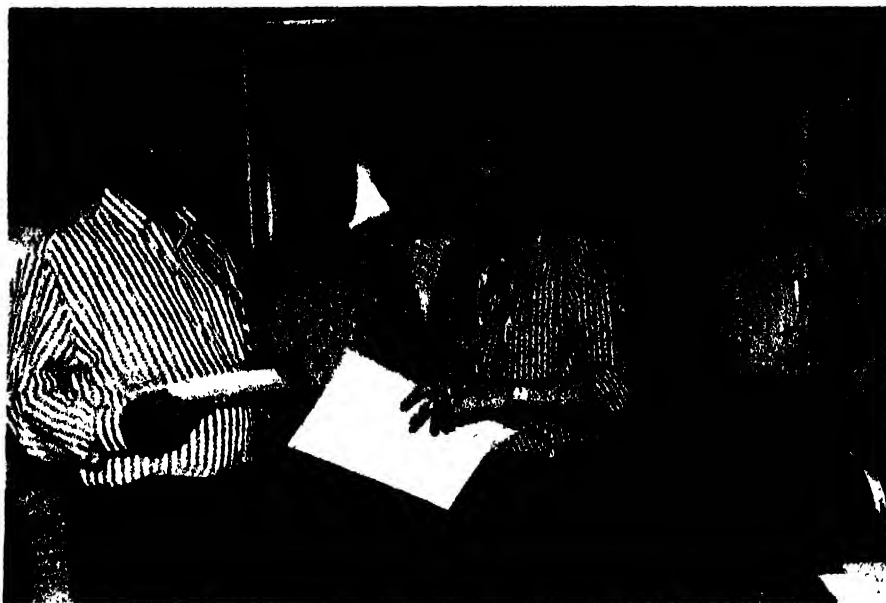
MENTHOL mint (*Mentha arvensis*) is fast becoming a commercial crop for the production of mint oil rich in menthol. Menthol finds use in cosmetics, pharmaceuticals, confectionary and liquor industries. Towards developing improved varieties with enhanced menthol yield and better morphometric traits, tissue culture mediated clonal selections have shown promise.

An approach to detect the polymorphism at molecular level has

IICB signs Contract to Standardize Herbal Drugs

THE Indian Institute of Chemical Biology (IICB), Calcutta, has entered into an agreement with Herbochem Remedies India (P) Ltd, for chemical analysis of herbal drugs with a view to standardize these. The agreement, signed on 4 March 1998, will continue for a period of three years.

Dr J. Das, Director, IICB, on the occasion of formalization of the contract said that IICB is charging a nominal amount for the new venture in the institute. In future, the charges for similar ventures will be substantially increased. □



Dr J. Das, Director, IICB, and Shri Bhaskar Ghosh, Director, Herbochem Remedies India (P) Ltd, exchanging the documents of signed contract. Others seen in the photo include: Dr B.C. Pal (concerned scientist), Shri J.L. Banerjee and Dr R.K. Ghosh

now been developed at the Central Institute of Medicinal & Aromatic Plants (CIMAP), Lucknow, using RAPD analysis of callus generated plantlets at the initial stage itself. The method involves a specific medium which induces rapid callusing, followed by successful regeneration of plantlets (calliclones).

Several combinations of 2,4D and 2iP were used in the ratios ranging from 1:20 to 1:40. The 1:35 combination induced the most rapid response. In this combination, the internodal explants produced callus from the cut end within two weeks. Regeneration of plantlets

started within eight weeks with profuse callusing. Consequently, over 50 plantlets could be obtained within 12 weeks with the callus continuously proliferating. These regenerated plantlets exhibited wide variability both at phenotypic and molecular levels. Several phenotypic variants were observed for fasciated stem, three leaved and multileaved plantlets, stem pigmentation and leaf margin variation. Variation at molecular level was detected through RAPD profiles using 12 random primers to relate the specific polymorphic bands with stable phenotypic variation. □

Antibacterial Activity of Fruits and Seeds of Some Tree species

PLANTS are known to produce various kinds of bioactive compounds in their natural course of life cycle as a part of the metabolic processes related to their survival under biotic and abiotic stresses of environment. Among these bioactive molecules, the compounds with antimicrobial activity might have the potential to be developed as plant-based antibiotics. The fruits and seeds of three important tree species – Indian walnut (*Albizia lebbek*), drum stick tree (*Moringa oleifera*) and Indian beech (*Pongamia pinnata*) – have been evaluated at the Central Institute of Medicinal & Aromatic Plants (CIMAP), Lucknow, using tissue discs or fragments directly for antibacterial activity against two infectious bacteria (*Salmonella typhimurium* and *Pseudomonas aeruginosa*) and *Mycobacterium smegmatis*, a non pathogenic species. In addition, a few laboratory strains of *Escherichia coli* were also used as the biological screen to understand specific mode of action.

Maximum activity against *M. smegmatis* was shown by *M. oleifera* seeds and fruits. *A. lebbek* seeds showed a higher activity against *S. typhimurium*. *P. pinnata* fruits showed general activity against all the three bacteria.

Ethanol extracts and various fractions of these plant parts in disc diffusion assays showed differential activity against specific bacterial strains.

These results indicate the presence of a highly potent antimycobacterial compound in the extracts CIM154-CIM156 which are being purified further by activity directed fractionation. □

NEERI SIGNS MoU with M/s Tamilnadu Distillers Association

THE National Environmental Engineering Research Institute (NEERI), Nagpur, has entered into an agreement with M/s Tamilnadu Distillers Association, for the management of wastewater in distilleries in Tamil Nadu. The Memorandum of Understanding (MoU) was signed on 12 March 1998. The contract is of Rs 20 million for a duration of twelve months.

The work schedule in phases I and II of the project will facilitate improvement in the performance of effluent treatment plants (ETPs) in operation. It includes site surveys in and around ETPs, delineation of inplant measures to minimize wastewater, generation, evaluation of quality and characteristics of combined wastewater, evaluation of ETPs, bench scale treatability studies, delineation of sludge management options, design of sludge management op-

tions, design of high rate transpiration system for utilization of wastewater, and delineation of measures for discernible improvement in the performance of existing ETPs through effective operation and maintenance of ETPs, if necessary.

The phase II of the project will include implementation of improvement measures suggested by NEERI in existing ETPs by the Tamilnadu Distillers Association, assistance in plant commissioning and trouble shooting, initiation of implementation of high rate transpiration system, training of plant operators, performance evaluation of the existing ETPs and ensuring that the ETPs conform to MINAS and TNPCB standards. Phase III of the project will include design and implementation of biosurfactant technology wherever applicable. □



Exchanging of documents following signing of MoU between NEERI and M/s Tamilnadu Distillers Association

NATIONAL GEOPHYSICAL RESEARCH INSTITUTE, HYDERABAD

R&D Highlights

THE National Geophysical Research Institute (NGRI), Hyderabad's R&D programmes are grouped under the following major areas: Seismology; Lithosphere, Earth's Interior and Environment; Groundwater; Geophysical Exploration, and; Geophysical Instrumentation. In addition, investigations are carried out by Special Activity Groups utilizing data from geomagnetic observatories, geoscientific studies in Antarctica, and Gravity Data Centre.

During the year 1996-97, the institute completed data acquisition of the ONGC sponsored project for mapping the sediments hidden below thick basaltic cover in the Saurashtra Peninsula. Recognizing the effectiveness of the methodology deployed by NGRI, the Director General of Hydrocarbon (DGH) has requisitioned NGRI to map a major part of Central India.

NGRI has been identified by DST to lead the multi-parametric geophysical imaging of the deep continent. This large scale integrated geoscientific experiment would cover the south Indian shield from 13°N to 8°N latitude and its result will be of immense help to Indian scientists and the global fraternity. The terrain being investigated is a rare region for delineating the nature of deep crust under Archaean-Proterozoic continent (age > 2.5 - 3.5 Ga). With the new data, certain basic questions on the evolution and dynamics of the continental crust would be addressed.

An innovative methodology has been proposed to study gravity field variation on regional and local

scales. The technique uses zero free air gravity values to deduce modified anomalies. This has proved quite powerful in arriving at new insights to tectonics and density distribution.

A major advance in institute's on-going earthquake studies in the Koyna-Warna region is the identification of certain precursory nucleations at shallow depths of 1-3 km, that precede magnitude 4 to 5 earthquakes at depths of 7-10 km. It is surmised that high pore-pressure plays a critical role in this process.

A National Workshop on Gold Resources of India was organized by NGRI, DST and GSI. The workshop dealt with the state-of-the-art and major results obtained so far in the exploration of gold in different parts of the country. The institute, during the year, participated in various exhibitions such as Geophysics Beyond 2000, Agrotech-96, and Petrotech-97.

The External Cash Flow (ECF) of the institute during 1996-97 amounted to Rs 118 million.

Institute's publications in journals covered by SCI increased by 30% from the previous year and a total of 57 papers were published in these journals. In addition, 48 papers in journals not covered by SCI, seven popular articles, one book, and 25 technical reports were published. One hundred and sixty six papers were presented in various seminars/symposia/conferences.

The institute was conferred many prestigious honours and awards. The Shanti Swarup Bhatnagar Prize in Earth Sciences, one of the most prestigious awards in S&T,

has been awarded to Dr S.S. Rai of the Seismic Tomography group. Dr P.R. Reddy, has won the National Mineral Award. The CSIR Young Scientist Award has been received by Dr Ajay Manglik. The A.P. Academy of Sciences has presented its Young Scientist Award to Dr (Ms) D.V. Ramana and Dr A.P. Singh. Shri B. Sreenivas has also won the Young Scientist Medal of Indian Science Congress. Dr B.K. Rastogi has been elected as the fellow of the Indian Geophysical Union. NGRI also won the prestigious Rolling Shield for the best performance in official language Hindi Implementation among the scientific organizations in the twin cities.

The major R&D activities carried out by NGRI during the period are:

Basic Research

The modelling of field data collected across the Central Indian Geotranssect shows a remarkable variation in the density on either side of the proposed shear/suture zone. A multi-parametric geophysical study in the thick sand covered area of the Thar Desert near Jaisalmer has been used to identify deep seated weak zones oriented broadly in the NNW-SSE and NE-SW directions. These zones play an important role in the emplacement of dykes during earlier magmatic episodes and for assessing groundwater circulation.

The geophysical deep sounding data has been, for the first time, successfully subjected to Simulated Annealing Inversion Technique. Study of the statistical structure of the internationally available geological

and geochemical data has brought out a periodicity of 25 ± 3 Ma in the dolomite abundance. This is important being very close to globally recognized cycle of ~ 26 Ma for many long period geological/geophysical time series, specially that of the mass extinction. In this connection another significant result is the observation of nearly catastrophic shift in the $^{87}\text{Sr}/^{86}\text{Sr}$ isotope ratio detected in the foraminifera picked up from the tertiary marine sediments in the Kutch region. The shift has occurred at the Eocene-Oligocene boundary and is indicative of $\sim 6^\circ$ of cooling. It therefore, suggests a major change in the geo-biosphere coupling during the Eocene-Oligocene boundary.

From the field studies in the south Indian shield, pseudo-tachylites have been identified in the Bhavani shear zone. Certain evidences suggest their age to be Cretaceous or even younger. Presence of these pseudo-tachylites in this and other shear zones (like Palghat-Cauvery, Moyar, etc.) has direct bearing on the evolution and reactivation of faults and more importantly on the occurrence of earthquakes in stable continental regions.

Paleomagnetic studies of the late-Proterozoic Vindhyan sediments and the Deccan Traps of the Latur region indicate a smooth migration of the subcontinent across the equator between the Rewa Sandstone and the Malani Rhyolites (1200-800 Ma); this result indicates that the earlier proposed migration of 75° is unlikely. The southeastern part of the Deccan Traps is estimated to have erupted during the Chrono 29 and magnetized almost totally in the reverse direction. Using the magnetostratigraphy, the

sedimentation rate of $0.33 - 0.54$ m/ 10^3 year has been estimated for Siwaliks in the Himalaya.

Indian continental lithosphere is considered to be affected by two or more plumes. Analysis of the tectonics and geophysical data from Sanchor to Broach provide the lateral variation in the extensional regime of a thinned mobile belt (Cambay-Western Ghat-Madagascar Belt) that moved over the Reunion mantle plume developing at the base of the lithosphere. From the Indian data it seems that transcontinental mobile belts form focii of break up of the supercontinent.

A large scale lateral transport of heat and mass would have occurred owing to outburst at about 65.5 ± 0.5 Ma of the Reunion plume near Broach. Studies on the associated tectonic and geophysical signatures help to bring out the spatial variation in lateral heat and mass transfers. The existing data suggest that the variation is caused by difference in the diffusion characteristics along

the deep-rooted rigid, cold and dry (Bundelkhand) craton and relatively thin, weak and hot mobile belts (viz. Satpura and Delhi-Aravalli). It is surmised that the shape of the Himalayan collision arc might be partly contributed by these differences.

For installing a permanent state-of-the-art Digital Seismological station at Maitri, feasibility study was carried out during XVI Antarctica Expedition by operating an analog seismograph. A vertical component S-13 seismometer (by Teledyne Geotech) was continuously operated in a shallow pit and recording was done using RV-320 B Portacorder by (Teledyne Geotech). The station worked satisfactorily. Also, sites have been selected for setting up permanent seismic and GPS stations during 1996-97.

Soil gas helium surveys were carried out over the Bhavani fault zone to understand the tectonics between the Bhavani and Moyar fault zones. Preliminary results indicate



RV 320B Portacorder Unit installed in the Tirumala Hut at Maitri Station, Antarctica along with GPS recording unit (left)

no anomaly on the zone and further work in other segments of the faults has been initiated. Helium anomaly over rupture zone of the Latur earthquake has been monitored periodically and it is observed that the anomaly levels persist. Heat-flow measurements carried out in Deccan Volcanic province (Wardha-Yavatmal) were continued apart from those reported earlier from Koyna-alore. A total number of 22 boreholes (over 150x220 km area) were covered. The heatflow in general is low.

Applied Studies

Gold anomaly maps have been prepared for the Chickasiddavahalli and Ramandurg areas of the Karnataka state.

Under geophysical exploration of hydrocarbons in the Saurashtra Peninsula region, the processing of the gravity data, acquired during the past two years, has been completed and free-air and Bouguer anomaly maps have been prepared. On the basis of deep electrical investigations, spatial variations in the thick-

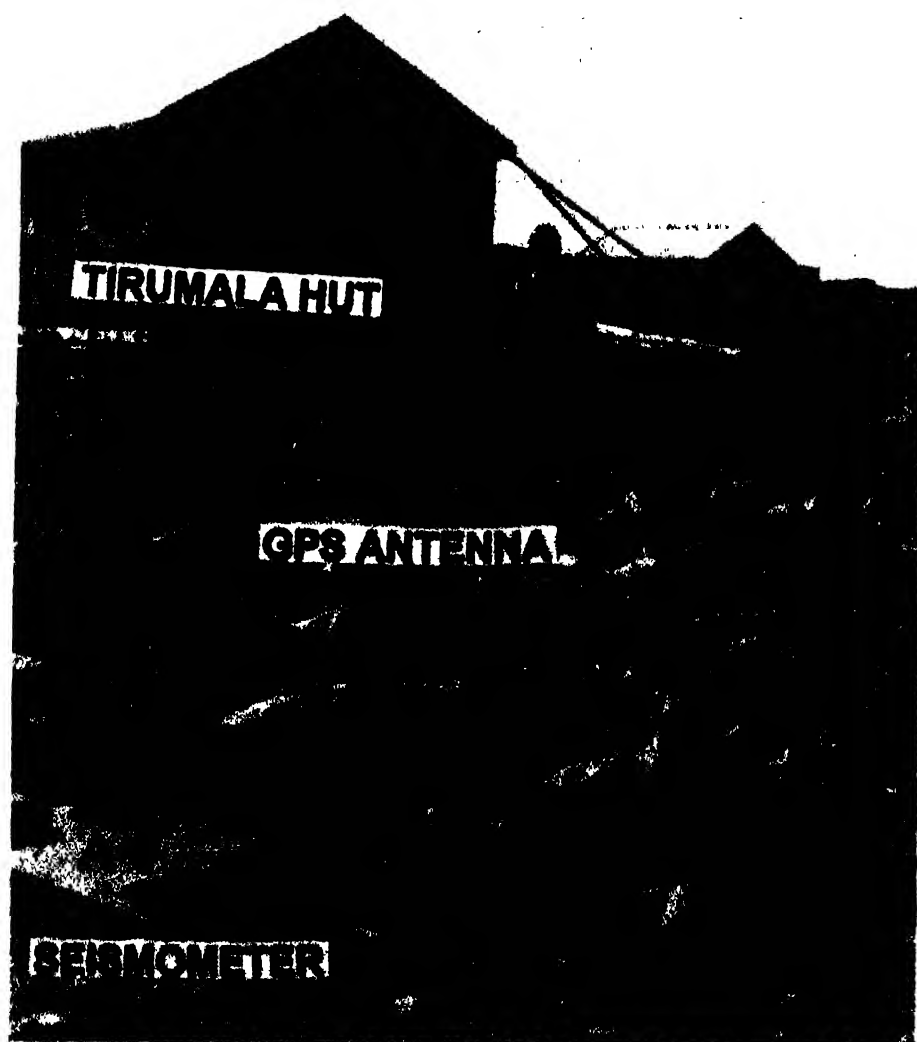
ness of trapcover and underlying sediments have been estimated. The northwestern part of the Saurashtra Peninsula has the maximum thickness of the sediments.

NGRI's ongoing investigations of the critical problems related to the groundwater exploration and management have brought out a 'Safe Pumping Scheme' for the Kavaratti, one of the major islands in the Lakshadweep group. On the basis of realistic model calculations, the proposed scheme outlines certain measures which need to be taken while exploiting fresh groundwater over the island.

In the Thar Desert, systematic hydraulic measurements reveal that vapour diffusion is the dominant process for the moisture loss. Approximately, 68% of moisture is lost to atmosphere in this region. On the other hand, the recharge during 1994-95 is found to be about 12% of the rainfall.

Geophysical and geological data, supplemented by physical oceanographic data such as sea bottom temperature and others, were analyzed to examine the scope for occurrence of gas hydrates in the marine sediments of the continental margins of India. Indicators for gas hydrate occurrence like bottom simulating reflectors and blanking zones were traced on a multichannel reflection seismic section off Mangalore Coast. The western continental margin appears to be a promising zone for gas hydrate occurrences.

Trace element analysis of samples from the Krishna river delta region shows evidence of transgressional and regressional movements. A few fresh water aquifers have been identified on either side of the



Location of the Seismometer pit (A) and the GPS Antenna (G) at Maitri Station Antarctica



Krishna Delta. These are located near Tenali in the south and near Vuyyur in the north of Krishna Delta.

The earthquake monitoring and analysis of mechanism of associated faulting is a major area of NGRI's thrust. The ongoing monitoring of seismicity near reservoirs show that most reservoirs have little or no seismicity.

With the objective of reconstructing the paleoseismological history of important seismic regions, studies were undertaken in a geological section at Ther, the epicentre of the 1993 earthquake of Maharashtra as well as in the Chedrang Fault Area of the great Assam earth-

quake of 1897, Shillong Plateau, Northeast India.

At Latur, displacement of certain strata was further confirmed on lateral exposure of about 2 m inside of the 9 m thick geological section laterally on the bank of the Thirna river. However, the faulted portion is confined to a height of 5 to 8.5 m from the present ground surface. The fault is further confirmed by measurements of the Radon emanation. The study substantiates the suspected seismic event in the historical past. Efforts are on way to establish and constrain this event from a number of trenches and radiocarbon dating of organic material.

For the Shillong plateau, identification, characterization, and dating of deformed sedimentary structures, induced by past violent earth movements, has led to the development of its Paleoseismology. Significant advances have been made to estimate probable recurrence time of past major earthquakes in certain regions of the world. In the Himalaya and adjoining regions, the paleoseismic investigations assume great significance in view of the tectonics and marked seismicity of the region, which has experienced four great earthquakes in the past century. The preliminary paleoseismological measurements suggest a recurrence period of about 500 years for

major earthquakes for this part of the Shillong Plateau and the adjacent Brahmaputra Valley in northeast India.

Investigations to develop suitable non-toxic water based polymer formulations for treating sandy soils of catchment areas of Rajasthan for enhancing runoff to the traditional water harvesting structures. The aim is to provide adequate supply of potable water to the rural people inhabiting the Thar desert. The project is in collaboration with Indian Institute of Chemical Technology (IICT) and Bhoruka Charitable Trust (BCT). The experiments were carried out to select suitable polymer formulations for field trials. The observed experimental results were highly encouraging and formed the basis for selecting polymer formulation for field experiment in Churu district, Rajasthan. In addition, experiments were initiated for studying the usefulness of polymer solutions in developing social forestry.

Natural recharge studies for water are being carried out in different agroclimatic zones of India with the objective of: Calculating the annual recoverable ground water potential for the country; Establishing a relationship between rainfall and recharge in different geological terrains; and Preparing a recharge contour map of India.

Artificial recharge experiments are being carried out in fluoride affected Nalgonda district of Andhra Pradesh with an objective to augment the drinking water sources of some villages in this district and also to reduce the fluoride content of ground water by recharging the aquifers using surface water containing low fluoride and abstracting the mixed water after a time gap.



Geological cross section showing fault and displacement of beds at right bank of Thirna river at Ther

Sponsored/Grant-in-Aid Projects at NGRI

Project	Sponsoring Agency	Cost of Project (Rs in million)	Funds received during 1996-97 (Rs in million)
MT study of crustal geoelectric structure in western India in relation to seismotectonic of the Deccan trap region: National facility to MT studies	DST	9.869	4.500
Isotopic event stratigraphy of Proterozoics of the Cuddapah & Vindhyan basins, India	KDMIPE-ONGC	0.833	0.160
Carbon & Isotopic excursion across Precambrian-Cambrian Boundary	DST	0.396	0.025
IDP-development of portable multi probe borehole logger	DST	1.650	0.500
Development of deep resistivity meter	DST	1.067	0.150
Dating of paleo-environmental events with special emphasis on paleo-seismic measurements	DST	0.455	0.090
Gravity-deep continental studies along Bareilly-Chindwara/Maunda- Rajnandgaon global geotranssect	DST	0.651	0.200
Seismicity study around Koyna-Warna reservoirs	DST	0.830	0.275
Geological & Geochemical investigations for gold mineralisation	DST	3.464	0.900
Digital instrumentation training course	DST	0.950	0.059
Seismic tomography of Sonata belt under deep continental programme	DST	6.722	0.500
Latur earthquake area direct information through drilling	DST	2.497	0.600
Artificial recharge structure evaluating their functional efficacy and evolving criteria for their siting	DST	0.617	0.400
Study of chemical pollution and its impact on soil, surface water and ground water in Patancheru and Bolaram Industrial Development area Medak district, Andhra Pradesh,	APPCB	0.987	0.500
Geophysical investigations along Nagaur-Jhalwar and Jaipur Raipur transect for scaling geology under the deep continental studies programme	DST	0.517	0.350
Seismic upgradation and related studies in Peninsular shield: procurement of telemetry seismic clusters and portable systems	DST	61.000	61.000
Establishment of geoscience database under deep continental studies programme	DST	2.029	1.700
Nature of picritic and magmas and sub-continental province	DST	0.040	0.040
Upgradation of digital telemetry at Tejpur	DST	2.300	2.100
Methodological integration of geophysical inversion	DST	0.850	0.490
Modelling the tectonic evolution of southern granulite belt of the Indian shield-tomographic studies	DST	8.500	4.100
CSSP, studies in Saurashtra, MT and Deep electrical and Modelling of gravity data studies in Saurashtra	ONGC	69.000	28.096
Appraisal and management of water resources in problem areas and measurement of natural recharge studies	DRD	—	0.050
Enhancement of runoff to traditional water harvesting structure in Thar desert using non-toxic polymer solutions	DRD	2.200	0.700
Natural and artificial recharge studies	DRD	0.960	0.300
Seismic monitoring at Sri Ram Sagar project	Government of A.P.	0.050	0.100
Assessment of ground water potential in Hayathnagar farm of CRIDA	CRIDA	0.130	0.289
Geophysical investigations at UCIL, Bhopal	NEERI	0.119	0.014

Contd.

Project	Sponsoring Agency	Cost of Project (Rs in million)	Funds received during 1996-97 (Rs in million)
Weak zones in granites	BARC	3.200	1.300
Geotechnical studies to determine the suitability of a proposed bridge site near Basholi across river Ravi	SERC	0.040	0.040
Gas hydrates exploration along continental margins of India	GAIL	2.875	1.000
Estimation of probable seismic hazard in Saurashtra	BASF India Ltd	0.020	0.010
Identification of suitable sites for disposal of solid waste at TCCL	TCCL	0.010	0.010
Estimation of increased ground water flow to the Kuteshwar limestone mines (Jabalpur Dist) M.P. as a result of dam construction on Son river	NMDC	0.630	0.268
Seismological studies at URAN	ONGC	0.400	0.100
Testing/Analysis	Different private parties	—	0.673
Inter Laboratory project on Indian standard reference materials	NPL	0.025	—
Coincident deep seismic reflection/refraction profile in Central India	DST	8.829	—
MT studies near Narmada-Son lineament and Bhandara craton in Central India	DST	1.092	—
Geochemical and Geochronological studies in Central Indian craton	DST	0.651	—
The recognition and characterisation of the Archaean Proterozoic boundary: A study from the Udaipur sector, Rajasthan	DST	0.425	—
MT investigations in Deccan syncline area of Nagpur-Belgaum profile	DGHC	10.500	—
Seismic hazard assessment for the Himalaya and NE regions	DST	0.440	—
Magnetic Polarity stratigraphy of the Shivalic sediments of the Himalayan foot hills	DST	0.367	—
Prediction of relative ground response around the slump belt of Bihar-Nepal earthquake of 1934	DST	0.211	—
Integrated geohydrological studies in Kongal basin	DRD	13.31	—
Seismological studies at Nagarjuna Sagar	Government of A.P.	0.100	—
Seismological studies at Srisailem	Government of A.P.	0.100	—
Micro earthquake investigations at Kudankulam nuclear power plants site	Nuclear Power Corporation (NPC)	1.092	—
Geostatistical and Operational Research to gold mineralisation	HGML	0.150	—
Assessment of ground-water resources in Kavaratti	Government of India	1.228	—
Evaluation of Geophysical/Geological data in northern Indian, Arabian Sea	Gas Authority of India Ltd.	0.600	—
Characterisation of kimberlite indicator minerals	Government of Orissa	0.200	—
Geophysical logging for delineation structure at Kalpakkam	BARC	0.280	—
In situ stress measurements at Kalpakkam	BARC	0.450	—
Groundwater Surveys in Karnataka	SC/ST Corporation, Karnataka	6.050	—
Preparation of geological and geochemical map for MSPL leased area, Hospet	MSPL	0.545	—
Geophysical investigations at Nagarjuna Sagar Right canal Phase II	Government of A.P.	0.175	—



The FEPACS Saga: From Concepts to Commercial Product

Dr Gangan Prathap
National Aerospace Laboratories, Bangalore

FEPACS (Finite Element Package for Analysis of Composites) is the first large software package (20,000 lines of Fortran code) from the National Aerospace Laboratories (NAL), Bangalore, to receive copyright registration (Indian Copyright L-15499/96), the copyright resting with the Council of Scientific & Industrial Research (CSIR), New Delhi. In view of the constraints under which the work has been carried out, it is a minor commercial success having been sold or licensed to five organizations (FSI, ACT, RRL Bhopal, SIT, CVRDE). Its claim to fame rests on its unique element library derived entirely from scientific first principles, three of which originated during a decade and half of basic research at NAL. This investigator-initiated research (unlike the mission-oriented research which receives nearly 96% of all R&D funding in the country today) has been done on a shoestring, with no company or foundation funding it in its first decade. Only over the last five years or so did the AR&DB agree to fund the development of the package.

The Finite Element Method (FEM) is an excellent example of a body of knowledge originating as Technology (Techne=Art or Craft) and rapidly becoming a commercial success. A hundred thousand or more engineers, technicians, teachers and students routinely use finite element analysis packages (of which there are nearly 1500 codes ranging from small dedicated in-house programmes to large general purpose megaline codes) in design, analysis, teaching or study environments.

There are billions of dollars worth of installed software and hardware dedicated to finite element analysis all over the world and perhaps billions of dollars are spent on analysis costs using this software every year. The primary archival literature has grown rapidly and there are more than 50,000 papers (excluding papers on fluid mechanics). Nearly 3800 papers are published annually. There are about 400 textbooks and primers, about 400 conference proceedings and perhaps thousands of handbooks, course notes and documentation manuals. Here, one has to make the crucial distinction between Technology and Science. While the former proceeds in an autonomous way from perceived needs of man, society and industry and is governed by utility, the latter always deals with economy and unity of understanding of basic principles.

There are very good reasons why the science of the fem grew in fitful and uncertain steps. It may serve us well to realize that the finite element method has progressed as far as it did precisely because there was more 'art' and 'engineering' and little mathematical rigour and less 'science' in the early years of its development. The invention of the method by engineers in very intuitive ways was the heroic phase of the subject, led entirely by bold pioneers. As Robert M. Pirsig described it so graphically in his *Zen and the Art of Motorcycle Maintenance*: "Pioneers [are] invariably, by their nature, mess makers. They go forging ahead, seeing only their noble, distant goal, and never notice any of

the debris they leave behind. Someone else gets to clean that up. Now that the noble, distant goal has been fully realized, it's the right time to clean up. This would be the main task of this account".

When the original members of the FEPACS Group (Gangan Prathap and G.R. Bhashyam) started work on the development of simple finite elements, there were only two canonical concepts governing the crucial discretization step which is the essence of the FEM. These were the completeness and continuity requirements on the special functions used to model the deformation within a structural region in an approximate (i.e. numerical) way. While these guiding rules were successful in a very large number of structural problems, it also became clear that classes of problems existed where these were recipes for disaster. (Typically, one could get numerical results which were larger than 99.9% in error! This was very reverently called the locking problem). The scientific framework which had emerged alongside the growth of the method was unable to account for these paradoxes. Albert Camus once said "All great deeds and all great thoughts have ridiculous beginnings". The locking problem, where errors were ridiculously large, could not be rationalised using either the continuity or the completeness requirements. Mark Buchanan said in a book review in *Nature* recently that if Camus had been a scientist, he might have added that all great theories have paradoxical beginnings. The review in question was of a book by

Etienne Klein. Klein's thesis was: "Paradox is truth standing on its head to get attention". In view of this, a "paradox focuses and amplifies intellectual stress [and] sets the stage for upheaval, discovery and sometimes scientific revolution."

The FEPACS Group made a bold move to establish that another canonical virtue they called consistency was behind the dramatic failures. Until then, all explanations offered for the locking phenomenon were heuristic; some of them were tautological or circular. Prathap and Bhashyam were able to show that the consistency paradigm had more than heuristic appeal; they were able to derive priori error models using this view point which could then be tested using numerical computations successfully. No other competing explanatory scheme could do this. Also, a variety of similar phenomena, many of them not originally recognized as belonging to the locking category, could be interpreted in a unified way. Further, the consistency paradigm allowed predictions to be made of phenomena which were not recognized or ignored and these were later found to be true.

"There is nothing so practical as a good theory," said Ludwig Boltzmann. The consistency theory now offered a means to build a library of practical elements (beam, plate, shell & solid) which were required for general purpose structural analysis. By this time, Bhashyam had made his way to more beckoning shores. Prathap continued the development of the linear elements with Ramesh Babu (who expired in 1986), and the quadratic, higher order and non-linear elements (work in progress) with B.P. Naganarayana, Ramamohan, etc.

Typically, a finite element computation produces parameters which guide a designer in making his decisions to optimize the structural efficiency and integrity of any load carrying system. Apart from the pattern of deformation, an engineer is principally guided by the state of strains (and stresses) in a system. There are prescribed allowable limits for each material used which cannot be exceeded without the system giving way (yielding, hence yield stress, etc.). Thus, the computation of strain and stress is of primary concern in finite element analysis. Around 1986, Babu and Prathap noticed that their field consistent library of elements could produce strains and stresses of remarkable accuracy at strategic points within each element. These were already known as optimal points, or Barlow points, after Barlow who first noticed them in the 70s.

Barlow attempted to derive the theory behind the existence of these points using the conventional interpretation that the finite element method was a piecewise version of applying the principle of minimum total potential (MTP) energy. The MTP is one variation of what are called the least action principles, one of the most basic statements defining matter, motion and energy, equally valid for quantum mechanics (as Feynman showed) as for classical mechanics (known from the days of Hero and Archimedes of 300 BC vintage). In the MTP interpretation, one is guided by the metaphysical assumption that underlying the finite element procedure is the fact that displacement (or deformation) fields are being approximated. Let this be called the displacement correspondence viewpoint.

To understand this more clearly, let us think of the finite element

computation as a process of sampling some incoming signal (a very useful metaphor introduced by Richard MacNeal, the prime mover behind the industry standard MSC-NASTRAN package, the MinMSC standing for MacNeal). Thus the MTP approach, which Barlow adopted, recognized that the displacement fields in the actual structure were being replaced by approximate displacement fields, and Barlow's prediction of optimal points followed from this paradigm. By the late 80s, it was obvious to Prathap that some of these predictions were wrong (Barlow's procedure could not identify the optimal points in cubic elements), and that this approach could not explain why in many problems, stresses at optimal points could be remarkably accurate (a phenomenon quickly named as superconvergence).

Around this time, a variational theorem proposed as early as 1955 by a little known Chinese engineer named Hu and published in an equally obscure Chinese journal began to be noticed. Hu's principle is another variation of the least action principle. Unlike the MTP which implements the least action principle in terms of displacement fields alone, Hu's principle is a multifield approach which enforces the least action principle by manipulating displacement, strain and stress-fields simultaneously. In classical analytical solutions (the FEM hardly existed when Hu proposed his theorem and almost all structural methods were based on analytical approaches), Hu's method offered no advantages (and no extra information) over the MTP principle. Hence it was largely ignored and even, in 1977, authoritative text books dismissed it as having no particular value.

In the early 90's, Prathap proposed what he called the stress correspondence view point as being central to the finite element process, as opposed to the displacement correspondence paradigm, which had been the framework accepted in all the 50,000 plus papers and 350 or so books written on the method. This is a typical situation in the scientific enterprise. The same data may have several different, and often opposite, explanations. FEM computations show that generally displacements are reasonably accurate and strains/stresses (these can be used interchangeably, being what are called conjugate quantities) are less accurate overall throughout the region. However, there are points, where stresses are very accurate; often, more accurate than displacements can be anywhere. Both the displacement and the stress correspondence paradigms could anticipate these general trends. This is a classical stand-off, where two competing paradigms are equally appealing in a superficial way. Usually, there is a psychological preference for the explanation that had arrived first. This tyranny of the first explanation can prolong periods of misunderstanding by thousands of years. Although Aristarchus had proposed the helio-centric model in 3rd century BC, it was the Ptolemaic earth-centred cosmology which ruled supreme for about fourteen centuries before Copernicus revived the Sun-centred model based on the same facts. A systematic programme of work by Prathap and Vinayak Ugru provided very accurate quantitative predictions based on the stress correspondence paradigm which could be

confirmed by numerical experimentation. The displacement correspondence paradigm could not match this as far as explanatory power was concerned. FEPACS now bases all its stress recovery procedures on this paradigm and Hu's principle, but it might take some more time for the stress-correspondence paradigm to overcome the tyranny of the displacement correspondence metaphor.

In going directly from the consistency to the correspondence concept in this account here, Prathap has taken some anachronistic liberties with the actual historical sequence in which the usefulness of Hu's principle was found. Along the way, the FEPACS Group also established the currency of a concept it called the correctness requirement. Coming back to the locking problem again, it happened that when the locking problems were first encountered, a variety of tricks (some successful, some not so) were used to remove locking. Consistency of-

fered an explanation for the success of many of these tricks. The MTP principle could not offer any procedure for attaining consistency. It turned out that only Hu's principle could provide a set of orthogonality conditions that assured that locking was removed in a variationally correct way. Unlike many general purpose packages which are commercially available, FEPACS has reconstituted all its elements using this correctness concept.

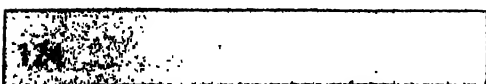
As of now, five canonical principles are recognized which guide the FE method—completeness, continuity, consistency, correctness and correspondence. While the first four are prescriptive rules (what you are enjoined to do to ensure robust elements), the last is a descriptive rule (defining exactly how the procedure works from an organizing principle like the least action principle). The FEPACS Group is hopeful that the consistency, correctness and correspondence concepts will one day be recognized as intellectual territory that will be forever Indian. □

Indo-German Round Table Meeting

A two-day Indo-German Round Table Meeting on 'Advanced Engineering and Technology Research and Application' was held on 4-5 March 1998, at the National Aerospace Laboratories (NAL), Bangalore. Five senior German experts, led by Prof. Dr Ing U. Diltthey, from the Technical University of Aachen met the Indian scientists and technologists from NAL, HAL, ADA, CABS, Daimler Benz Research Centre, Indo-German Chamber of Commerce and SERC, Chennai, to share their experiences, and discuss new collaborations in

the areas of materials and structural engineering, telecommunication, fibre reinforced plastics and metal finishing.

The meeting opened with a brief inaugural session in the Composite Structures Lab. Dr T.S. Prahlād, Director, NAL, welcomed the participants and invited the German scientists to interact closely with their Indian colleagues stressing that the days of working in isolation are over. In response, Prof. Diltthey expressed his happiness that opportunities to work with India were grow-



ing. "We see this interaction as a two-way road involving both technical and human exchanges and hope that it will provide the umbrella for joint collaboration between CSIR, IITs and Aachen Uni-

versity", he said, explaining how a similar programme between East and West Germany had proved to be enormously useful in the early years after German reunification. □

National Conference on Emerging Trends in Electrometallurgy and VIII National Convention of Electrochemists

THE National Conference on 'Emerging Trends in Electrometallurgy and VIII National Convention of Electrochemists' was organized by the Society for the Advancement of Electrochemical Science and Technology, Karaikudi, in collaboration with Central Electrochemical Research Institute (CECRI), Karaikudi, during 28-30 January 1998. The conference was co-sponsored by All India Council of Technical Education (AICTE), New Delhi, CSIR and DST. It had more than 100 participants from various Universities, CSIR, IIT and other institutions. The conference was inaugurated by Dr M.

Raghavan, Acting Director, CECRI, Karaikudi.

The five technical sessions focussed on electrometallurgy, corrosion and metal finishing, electrochemical materials science, and electrochemical materials science, and electrochemical materials science, and electrochemical materials science. A select band of eminent scientists gave invited lectures covering all the latest developments and future prospects in different areas of Electrochemistry.

During the conference, Prof. Doss Memorial Lecture was delivered by Prof. C.V. Sundaram, Visiting Professor, National Institute of Advanced Studies, Bangalore. □

Workshop on Updating Corrosion Map of India

A one-day workshop on 'Updating Corrosion Map of India' was organized by the National Corrosion Council of India (NCCI) at Triple Helix Hall of Central Leather Research Institute (CLRI), Chennai, on 20 February 1998 in collaboration with Central Electrochemical Research Institute (CECRI), Karaikudi. Nearly 70 participants from major public sector undertakings, R&D laboratories, educational institutions and industries such as paint industry, steel industry and fertilizer industry, etc. participated.

Inaugurating the seminar, Dr Placid Rodriguez, Director, Indira Gandhi Centre for Atomic Research, Kalpakkam, said that the losses, owing to corrosion in our country are enormous. He felt that this loss is being grossly underestimated as loss of human life owing to corrosion failures can never be accounted for. Hence, he reiterated that establishing an updated corrosion map of India is an urgent necessity and appreciated the fact that it is being undertaken. He advised to concentrate continuously on the task ahead even though the scope of work might widen more and more as they proceed.

Dr M. Raghavan, Director, CECRI, presided over the inaugural function. He said that corrosion is so slow a process that one normally tends to ignore it as insignificant, which ultimately leads to unimaginable loss.

Dr T.M. Balasubramanian, Vice-Chairman, NCCI and convener of



Dr M. Raghavan, Acting Director, CECRI, delivering his inaugural address at the conference on 'Emerging Trends in Electrometallurgy and VIII National Convention of Electrochemists'



Dr Placid Rodriguez, Director, Indira Gandhi Centre for Atomic Research, Kalpakkam, delivering his inaugural address at the workshop on 'Updating Corrosion Map of India'

the workshop welcomed the gathering.

Offering his felicitations, Shri P.F. Anto, General Manager, IEOT, ONGC, Panvel and Vice-chairman of NCCI, said that the corrosion map once completed will help in 'preventive maintenance' and be of immense use to the industries which should come forward and support the project.

Dr T. Ramasami, Director, CLRI, also offered his felicitations. He said that corrosion is associated even with leather industries. The most vulnerable components are the dies and other metal components used in the manufacture of footwear. Corrosion results in the rejection of finished products, especially those aimed for export market leading to loss owing to corrosion.

Dr K.S. Rajagopalan, Former Director of CECRI, and Dr R. Narayanan, Dy. Director, Structural Engineering Research Centre, Chennai, also offered their felicitations.

Dr N. Palaniswamy, Secretary, NCCI and Asst. Director, CECRI, proposed a vote of thanks.

Technical Session

In the technical session, Prof. K. I. Vasu founder patron of NCCI and Former Director of CECRI, highlighted the details of the workshop and its benefits to the industries.

Dr G. Subramanian, Scientist-in-charge, Mandapam Camp, presented the International Scenario on Corrosion Map of India

Dr Balasubramanian, highlighted the methodology of approach and invited the participants for their suggestions on the same.

Shri P.S. Mohan, Scientist, CECRI, detailed the various stages that have to be followed in correlating the corrosion data with meteorological and pollution data.

The various protective coatings systems that can be studied were highlighted by Dr P. Jayakrishnan, Scientist, CECRI.

The technical session concluded with detailed presentation by Dr M. Natesan, Scientist, CECRI

on the proposed budget for this project.

Later, each participant expressed his views on various aspects of the proposed project. The expert panel for this session consisted of Dr M. Raghavan; Prof. G.N. Mathur, Director, DMSRDE, Kanpur; Dr K. Elayaperumal, Corrosion Consultant, Mumbai; Shri P.F. Anto; Dr T.M. Balasubramanian; Dr N. Palaniswamy, Secretary, NCCI. The session was chaired by Prof. K.I. Vasu.

The opinions expressed by the participants were discussed and necessary clarifications were made by the expert committee.

All the participants unanimously agreed to extend all possible services and signed a declaration. The session concluded with a vote of thanks delivered by Dr Palaniswamy. □

National Workshop on Rice Processing

A two-day National Workshop on Rice Processing was organized by the Central Food Technological Research Institute (CFTRI), Mysore, during 5-6 February 1998, to discuss the status of industry in the country. The workshop was sponsored by the Ministry of Food Processing Industries (MFPI), and inaugurated by Shri Ashok Parthasarathi, Secretary, MFPI, Government of India.

Briefing the gathering about genesis of the workshop, Dr V. Prakash, Director, CFTRI, underlined the employment opportunities offered by the rice processing industry. In his inaugural address, the Secretary pointed out, "largest number of agricultural labourers find

employment in this industry and more than 80% of the country's population depends fully or partially on rice as its main cereal food and staple diet". Besides, rice exports bring in valuable foreign exchange. Nearly 50% of the *basmati* rice produced in the country (about 4.5 lakh tonnes) is marketed abroad. Pondering over the problems facing the industry, Shri Parthasarathi said that a huge amount of paddy goes waste during post-harvest processing mainly owing to lack of adequate infrastructural facilities, poor handling practices during storage and transportation and improper packaging. Substantial amount of nutrition is also lost from the grain during milling. "If milled properly, nearly 70 to 75% of paddy can be recovered as rice that is rich in protein, essential amino acids as well as natural vitamins", he pointed out.

More than 100 scientists, rice millers and taxation experts participated in the deliberations of the technical sessions which focussed on specific aspects like the milling and packaging, products and byproducts of rice processing industry. Matters related to export policy and taxation were also discussed. Shri A. Srinivas, Scientist, CFTRI, and his colleague Shri B.V. Satyendra Rao discussed the status of the rice milling industry in India, and its developments in relation to the global developments in rice milling technology and packaging. Representing the Karnataka Rice Millers' Association, Shri D.P.V. Bhat, outlined the different technological, taxation and tariff problems faced by the rice millers. Shri K.R. Kumar, CFTRI, highlighted the problems in packaging and storage of rice and paddy, and the technological solu-

tions CFTRI had developed for these. Discussions on the modern milling system in use in the country, and the various researches underway at CFTRI to improve the mills were also held. CFTRI has initiated work on developing plastic rollers with low wear and tear as a replacement for the rubber rollers used currently for milling of rice. Similarly, the designs of paddy cleaners, magnetic separators are also being improved at the institute to increase both the capacity and efficiency of the units. Research findings on the optimum conditions of paddy storage, which could help attain better milling yields of good quality rice, were also discussed.

In the session on products/byproducts and energy management in rice milling industry, the enormous potential of both rice bran and rice husk was brought out by Dr M.K. Bhashyam, Scientist, CFTRI. A substantial amount of rice husk, which is a good source of silica, gets wasted in the form of an

inefficient fuel for boiling water during parboiling of rice. Most of the rice bran which yields useful bran oil and nutritious cattle feed is not available for extraction of the oil because of use of outdated equipment, like hullers, by a majority of small-scale rice mills.

Energy management in rice mills was discussed by Prof. H.S. Mukunda of Indian Institute of Science, who pointed out that gasification of husk offers a profitable means of disposal of about 25 million tonnes of rice husk produced in the country, besides providing an alternative source of energy. A couple of power plants run by rice husk gas are already functioning in Andhra Pradesh, Haryana and Madhya Pradesh.

The husk could also be used for manufacturing building materials like boards, chemicals such as furfural, sodium silicate, silicon carbide and precipitated silica, indigenous technologies for which are available.



Inaugural function of the 'National Workshop on Rice Processing' held at CFTRI, Mysore. Seated on dais (from left) Dr S.Z. Ali, Head, Grain Science Technology, CFTRI; Shri A. Parthasarathi, Secretary, Ministry of Food Processing Industries, Government of India; and Dr V. Prakash, Director, CFTRI

Shri H.V. Narasimha, Scientist, CFTRI, discussed the conversion of paddy to various products. Necessity for modernization of processes for three popular traditional rice products namely flaked rice, puffed rice and popped rice was highlighted. Some technologies have been developed at CFTRI and are awaiting commercialization. During another session, Brigadier Anil Adlakha, Executive Director, All India Rice Exporters' Association, New Delhi, expressed the hope that India could become the world leader in rice export if some of the technological problems outlined above could be addressed to immediately.

A panel discussion to plan the future course of action for making Indian rice processing industry globally competitive was also held during the workshop. An outcome was the decision to set up a taskforce including the rice exporters, rice producers, financial institutions, scientists and technologists to draw an action plan for furthering the interests of Indian rice industry and help it realize its true potential.

The workshop ended with a special talk on contributions of CFTRI in the field of rice milling and processing, delivered by Dr S.Z. Ali. Outlining the progress of rice research in India, he brought out the fact that nearly 50% of the parboiled rice is being produced in the country based on CFTRI technology.

On the occasion, two of the veteran rice scientists, Dr H.S.R. Desikachar and Dr K.R. Bhattacharya were honoured for their pioneering contributions in the field of rice research. □

HONOURS & AWARDS

Dr Harsh K. Gupta

DR Harsh K. Gupta, Director, National Geophysical Research Institute (NGRI), Hyderabad, has received the Second International Outstanding Performance award of Iranian Research Organization for Science and Technology (IROST). The award carries a certificate, a plaque and US \$ 3000 in cash.



President of the Islamic Republic of Iran presented the award to Dr Gupta on 4 February 1998 for his significant work on artificial water reservoir-induced earthquake studies.

The selection was made among 861 nominations in several scientific areas from different countries for the 11th International Kharazmi Festival organized by IROST.

During his stay at Iran (30 January - 6 February 1998), Dr Gupta delivered three lectures at the Institute of Geophysics of Iran, Tehran University of Science and Technology and the Department of Civil Engineering. □

Dr S.N. Rai

DR S.N. Rai, Scientist E-II, National Geophysical Research Institute (NGRI), Hyderabad, has been awarded Fellowship of the Indian Association of Hy-



drologists, Roorkee, in recognition of his outstanding contributions to the field of Hydrology. He has made significant contributions to the area of groundwater flow modelling and published several research papers on this subject in various international/national scientific journals and proceedings of seminar/symposia. These models are useful in the prediction of spatio-temporal variation of the water table and in quantifying effects of various controlling parameters such as duration and intensity of recharge rate, dimension and location of recharge basins, aquifer parameters, etc. on watertable fluctuations. Such information is essential for the proper management of groundwater resources.

Dr Rai is a member of the International Association of Hydrologists, International Association of Hydrological Sciences, Indian Geophysical Union, Institution of Geoscientists and Association of Exploration Geophysicists. He is a member of the Research Council of Delta Studies Institute, Visakhapatnam. □

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CSIR NEWS

Radome EM Design Software Package (AAVRITA) developed at NAL

THE Computational Electromagnetics (CEM) Lab. of the National Aerospace Laboratories (NAL), Bangalore, has developed a comprehensive software package Aavrita, for the electromagnetic (EM) design and analysis of radomes. Both the ground-based and air-borne radomes are within the scope of this software package. Radomes (monolithic or sandwich type) can be designed with preselected materials of the user's choice. The primary motivation for the development of Aavrita package came from the software policy enunciated in 1996 by Dr T. S. Prahlad, Director, NAL. This policy emphasized the aspects of consolidation, standardization and validation of software with the explicit aim of developing user-friendly products.

Radome is a covering to the radar or antenna to protect it from environmental elements such as wind, rain, snow, etc. It is primarily an EM window which endeavors to

provide a free space like environment for the antenna. The *ab initio* design and development of radome, which meets the client-supplied specifications, is a highly intensive interdisciplinary activity. The development of Aavrita is a culmination of over four years of interaction of the CEM Lab., with the Radome Design Team and the Radome Fabrication Team.

Aavrita aims at providing design solutions from the EM perspective. Further, the uncertainties owing to the variation in the material properties and the fabrication processes, have been accounted for in the software. Given a radome design, Aavrita is capable of analyzing it with respect to the EM performance parameters such as transmitted power, reflected power, voltage standing wave ratio (VSWR), insertion phase delay (IPD), etc.

The input parameters have been defined with default values which

are typical of those found in literature. This facilitates navigating through the package by mere stroke of keys. These default values can nevertheless be changed by the user to suit specific design requirements.

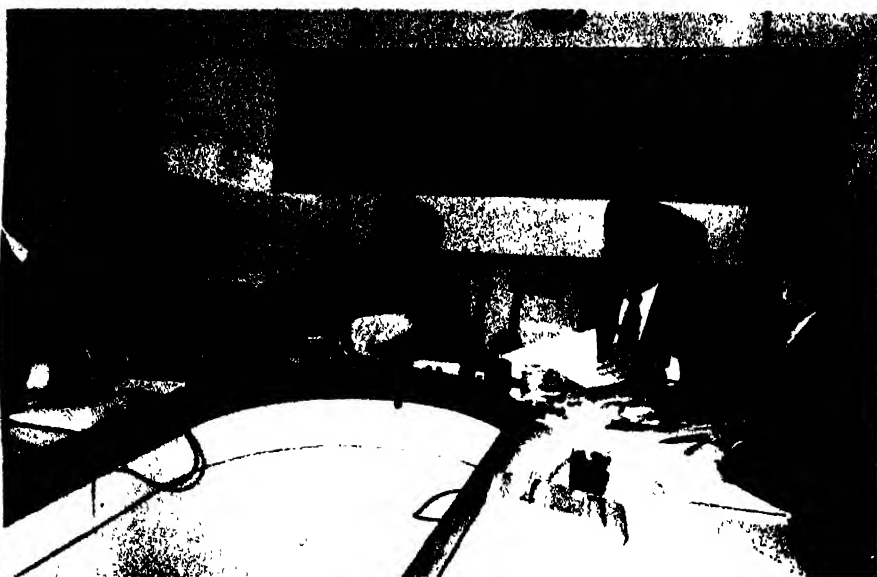
The design and analysis results can be displayed on screen either as plots or in tabular format. Further, a feature has been incorporated to view these tables about any pivotal point since these tables are often very large. There is also an option for storing the data as files for further processing.

The current prototype package, which is in Fortran, is menu driven and can be adapted for most of the computational platforms. Aavrita has been extensively validated against the results available in literature. The CEM Lab. is now developing an advanced version of the software with improved graphic user interface (GUI).

CMERI Signs MoU with NTPC

THE Central Mechanical Engineering Research Institute (CMERI), Durgapur, has signed a Memorandum of Understanding (MoU), with NTPC on 12 December 1997 to undertake collaborative work in the areas of mutual interest. The agreement was signed by Shri S.K. Sanyal, GM (R&D), NTPC and Shri Hardy Singh, Director, CMERI, in the presence of senior officials of both the organizations.

The agreement would provide initial thrust in the area of Non-Destructive testing leading to Residual Life Assessment (RLA) of power plants. CMERI will provide its facilities and expertise to NTPC for further development of testing procedures and to create further quality consciousness, exposure and exchange of information in both the organizations. The MoU will open up new horizons in R&D in power sector. □



Shri S.K. Sanyal GM (R & D), NTPC, and Shri Hardy Singh, Director, CMERI, signing the MoU on behalf of NTPC and CMERI respectively

R&D FLASHES of IHBT

Damask Rose Varieties released

DR R. A. Mashelkar, Director General CSIR, has released two varieties of Damask rose (*Rosa damascena* Mill.) developed by the Institute of Himalayan Bioresource Technology (IHBT), Palampur, christened as *Jwala* (IHBT - Gulab I) suitable for cultivation in plains and *Himroz* (IHBT-Gulab II) which flowers well in the mid Hima-

layan regions. The two varieties have been confirmed by DNA fingerprinting and assessed for variation in morphological characters. The varieties when grown in recommended agroclimatic zones, give consistent flower yield and oil quality.

The planting material of *Jwala* and *Himroz* varieties is available for sale with IHBT. Planting can be

done during July-August or November-December.

Tea in Non-traditional Areas of Himachal

IHBT, after intensive survey and soil analysis, has launched tea plantation in non-traditional areas in the districts of Chamba, Mandi and Kangra. People of Sihunta area in Chamba particularly have shown great interest in tea plantation. Out of the seven young tea trial plots, planting in five plots was over by summer and remaining two were planted during winter. This is a unique example of crop diversification from field crops to tea plantation. This project is sponsored by the Tea Board of India. It is envisaged that appropriate schemes along with incentives and technical guidelines by the state government and the Tea Board of India will open a new chapter in the history of tea in Himachal Pradesh.

Micropropagation of Tea and Bamboo

Large number of IHBT micro-propagated tea plants have been successfully transferred and established under field conditions and the novelty of this technology is being patented.

Using four and eight leaf cuttings, rooted tea plants could be transferred to field after nine months with conventional methods of propagation. This approach was found useful and practical demonstration of its application has been made in the planter's fields in the spring season.

Work is underway for the micro-propagation of *Bambusa bambos* (= *B. arundinacea*), a bamboo of medicinal importance.

Biodiversity Conservation

Field surveys were conducted for collection of important economic plants from regions of Lahaul & Spiti, Chamba, Bharmaur and Kullu districts.

Vegetative propagation of hardwood cuttings of *Hippophae* was successfully carried out using cer-

tain PGRs. During agronomic experiments in *Valeriana wallichii*, phosphate application increased valepotriate content in the roots.

Isolation of genomic DNA from different accessions of *Artemisia* and *Valeriana* was done after standardization of parameters for isolation of DNA in pure form. □

CMERI Receives ISO-9001

THE Central Mechanical Engineering Research Institute (CMERI), Durgapur, has received the ISO 9001 : 1994 Quality System Certificate with effect from 29 January 1998. The certificate has been awarded by M/s DET NORSKE VERITAS (DNV) of The Netherlands accredited by the RVA. The certificate is valid for the following product and service ranges: (A) Design, development and manufacture of Industrial machines and automation products, Farm machinery and post-harvest technology, Process plant and equipment; (B) Manufacturing technology including rapid prototyping and tooling, precision casting and foundry, and; (C) Testing, evaluation and assessment of engineering materials, components and selective products, calibration of instruments and gauges and manpower training.

To commemorate this landmark achievement, a Certificate Presentation Ceremony was organized in the institute on 8 March 1998 with Dr R. A. Mashelkar, Director General, CSIR, as the Chief Guest. The ISO-9001 Certificate was handed over to Shri Hardyal Singh, Director, CMERI, by Shri D. K.S. Moorthy,

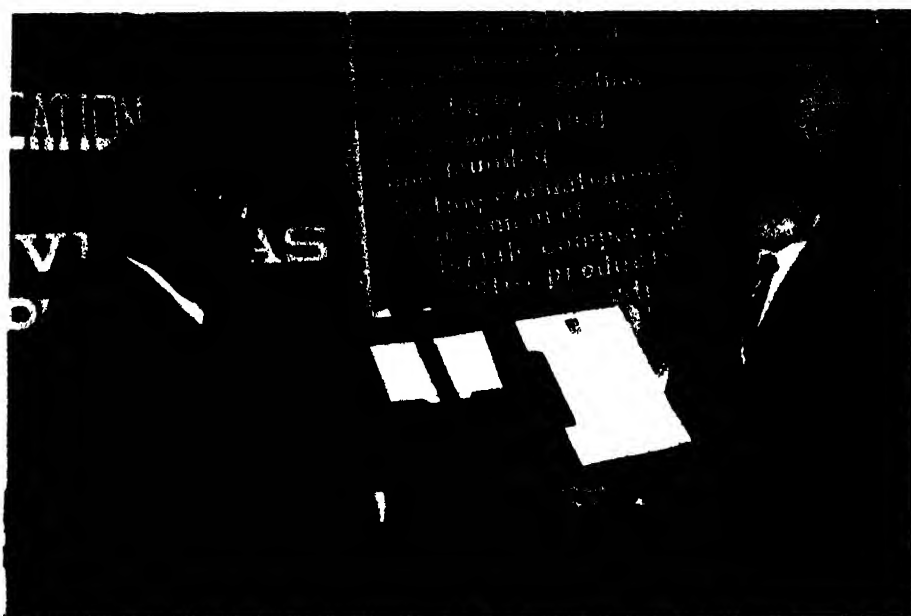
Lead Auditor & Station Manager on behalf of M/s DNV.

During his address, Dr Mashelkar said that CSIR was proud of CMERI for this excellent achievement and expressed his deep and warmest congratulations to the entire staff members of CMERI and MERADO Centres for the great team spirit and total commitment shown in achieving the internationally recognized Quality System Certificate. He added that CMERI is the first amongst all the CSIR laboratories which has achieved ISO-9001 Cer-

IHBT signs MoU with GNDU, Amritsar

THE Institute of Himalayan Bioresource Technology (IHBT), Palampur, has signed a Memorandum of Understanding (MoU) with Guru Nanak Dev University (GNDU), Amritsar, for the award of Ph. D. to research scholars working at IHBT. The agreement was signed by Dr S.H. Soch, Vice Chancellor, GNDU and Prof. Akshey K. Gupta, Director, IHBT, in the presence of Dr R.A. Mashelkar, Director General, CSIR. □

tificate, but second in the chain for having received such certificate conforming to international standard. Considering many of the current achievements of CMERI, viz. Modern Management Information Systems, LAN, WEB Page, Innovative Human Resource Development



Shri Hardyal Singh, Director, CMERI, receiving the ISO-9001 Certificate by Shri D.K.S. Moorthy, Lead Auditor & Station Manager, M/s. DNV

Programmes, RLA as well as design and development of many challenging products and processes, CMERI is a Star Performer amongst the CSIR laboratories. He was very much hopeful that in view of the excellent performance of the entire CMERI team, the laboratory can act as a 'Centre of Excellence' in providing consultancy services to many organizations including sister laboratories in certain specific areas. According to him, three vital elements, i.e. innovation, compassion and passion were effectively blended in CMERI for achieving the desired goal. He advised all the staff members of CMERI to continue this great team effort so that the institute can earn many more achievements in the years to come.

Welcoming all the distinguished guests and dignitaries present on the occasion, Shri Hardy Singh, Director, CMERI, pointed out that CMERI's total commitment to quality and professionalism has been reflected in its being awarded the ISO-9001 Certificate. CMERI is now ready to take up development of globally competitive and challenging technologies using R&D tools in order to satisfy the priority needs of industrial sectors towards quality, delivery and cost of technology & services, he added.

Shri K. N. Rao, Scientist & Management Representative of CMERI for ISO - 9001, explained the steps and procedures undertaken for achieving the same.

On this occasion, a modern R&D Block was inaugurated by Dr Mashelkar. All the distinguished visitors were shown round the various ongoing activities of the institute. □

Contract/Consultancy Projects taken up/completed at RRL-Jorhat

THE contract/consultancy projects taken up/completed recently by the Regional Research Laboratory (RRL), Jorhat, are as follows:

Contract/Consultancy Projects taken up

- Chemical modification of lignite and its application in beneficiation of Iron ore fines and slimes for Joint Plant Committee, Calcutta.
- Linkage catalyzed stereoselective synthesis for building block for cardiovascular drugs for the Department of Biotechnology, New Delhi.
- Promotion and cultivation of aromatic and medicinal plants, viz. *Java citronella*, Lemongrass and Patchouli for the sustenance of the ST population of Arunachal Pradesh in India for the Department of Biotechnology, New Delhi.
- Development of suitable cottage scale technologies for extraction of fibres from plant materials of forest origin for Indian Council of Forest Research and Education, Dehra Dun.
- Utilization of weeds abundantly available in the forests of Assam for the manufacture of low and medium density fibre/particle boards for the Indian Council of Forest Research and Education, Dehra Dun.
- Consultancy on *Java citronella* to Sanjay Arya, Guwahati.

Contract Projects completed

- Studies on toxic metal in the soil water system in and around Lakwa Oil Fields with special reference to Tea gardens around, undertaken on behalf of the Ministry of Environment and Forests, Paryavaran Bhavan, New Delhi.
- Investigation on mine support material and determination of bearing capacity of underground road-ways for Coal India Ltd (NE Coal Field Ltd), Margherita.
- Baseline study of spice industry in North Eastern India for Spice Board, Ministry of Commerce, Cochin.
- Commercial resources of *Cinnamomum* spices in the Eastern Himalayan Region of India — survey, identification and conservation for suitable use on behalf of G.B. Pant Institute of Environment Development, Almora, U.P.
- Soil Investigation for tankage area and Marketing Terminal at NRL for Numaligarh Refinery Ltd, Golaghat.
- Design and fabrication of garbage bins for Jorhat Municipal Board, Jorhat.
- Design and fabrication of M.S. nozzles for KarDi Anglong Chemicals (P) Ltd, Diphu. □

NATIONAL INSTITUTE OF OCEANOGRAPHY, GOA

R&D Highlights

R&D activities of the National Institute of Oceanography (NIO), Goa, during 1996-97 are grouped under: Contract Services; Coastal Environment; Engineering, Techniques & Technology; and offshore Processes & Resources.

An open week was observed for 9th Plan projects and some multi-disciplinary projects were successfully forged during 1996-97 (the last year of the 8th Plan). This exercise and other associated restructuring exercises are expected to be helpful in the recently enunciated Vision 2001 by Dr Mashelkar with its various milestones.

During the period under report, the institute earned External Cash Flow of Rs 110.1 million as against the CSIR funding of Rs 129.8 million. NIO undertook 70 sponsored and seven grant-in-aid projects.

A total of 14 cruises were undertaken, eleven on board ORV *Sagar Kanya* and the remaining on the chartered Russian vessel *A. A. Sidorenko*. Five cruises were for collection of geological and geophysical data and for environmental impact assessment studies in the Central Indian Ocean Basin under the project 'Surveys for polymetallic nodules'. Two cruises were exclusively for 'JGOFS - India Programme' and one for validation of data on ocean colour collected on-board the Indian Remote Sensing Satellite IRS P3. Report on JGOFS (India) data management was submitted to the International JGOFS data management group. One cruise was also undertaken in the Bay of Bengal to document the seasonal and annual variability of ther-

mohaline properties and circulation features for World Ocean Circulation Experiment (WOCE) programme.

The regular pollution monitoring along Ratnagiri - Goa under the Coastal Ocean Monitoring & Prediction System (COMAPS) programme was continued on-board CRV *Sagar Paschimi*.

During the period, the institute's library was recognized as the National Information Centre for Marine Sciences (NICMAS) by the National Information System for Science and Technology (NISSAT), Department of Scientific and Industrial Research (DSIR), Government of India. The mandate of this centre is to provide information services to all users and create a bibliographic Indian Ocean Database. So far, around 10,000 references with abstracts have been added. Database on the Catalogue of Library Holdings (OCEANLINE) and contributions by NIO scientists (NIOPUB) are available on the NIO Website. The library continued the ASFA CD-ROM and Current Contents Search Service on Diskettes (CCOD). It provided 870 references on aquatic sciences to the ASFA database.

The institute participated in a one month long exhibition 'Goa Vision 2001' organized in Panjim.

NIO continued its strong tradition of bilateral collaborative science programmes with laboratories of excellence situated in various parts of the world. The major collaborations during 1996-97 have been Indo-US, Indo-German and Indo-EC-Dutch.

Application of biochemical and molecular techniques to characterize ocean trophic dynamics was studied under Indo-US bilateral programme. Studies on carbon and nitrogen content of leaves, roots and pneumatophores of *Rhizophora apiculata*, *R. mucronata*, *Avicennia marina* and *A. officinalis* and of the litter fractions of major species of mangroves (*A. marina*, *A. officinalis* and *Sonneratia alba*) are being carried out. Remineralization studies of leaf litter of four mangrove species (*R. mucronata*, *R. apiculata*, *Sonneratia alba* and *A. officinalis*) are in progress. Experiments on uptake and assimilation by phytoplankton of nitrogenous nutrients of the water column and sediment are being carried out at monthly intervals in a mangrove ecosystem. Wooden panels of *Mangifera indica* were exposed for different periods showing that *Martesia striata* and *Nausitora hedleyi* are the dominant forms of wood borers. The measurements of dual isotopic composition of dissolved N₂O in oxygen-deficient waters of the Arabian Sea show that denitrification leads to mid-depth enrichments of both ¹⁵N and ¹⁸O in N₂O, that are by far the largest reported from any natural environment.

Under Indo-German collaboration, two sediment trap mooring samples in the central and northern Bay of Bengal were analyzed for planktic foraminiferal abundance. Particle flux data obtained by time series sediment traps deployed over the years in the Arabian Sea were compared with the wind speeds computed from satellite data showing that there is a strong relationship



Existing between physical and biological processes related to the SW monsoon in the Arabian Sea. Investigations on contaminants in the marine environment and their fate in the abiotic and biotic compartments with emphasis on the biological response of organisms were carried out under Indo-EC-Dutch collaboration. The analyses of the data on selected pesticides polychlorinated biphenyls and genotoxic effects of such chemicals continued.

Dr. S.W.A. Naqvi was honoured with the Shanti Swarup Bhatnagar Prize for 1996 in Earth, Atmosphere, Ocean and Planetary Sciences. His research on biogeochemical cycling has greatly improved the understanding of the processes unique to the hypoxic environments with implications on ocean productivity, atmospheric composition and climate. Dr Shyam M. Gupta received the Rajiv Gandhi Research grant from Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore, for developing innovative ideas in Paleoclimate and Dr Shridhar Iyer was awarded the Raman Research Fellowship to work on "Volcanics of the Central Indian Ocean", at Michigan Technology University, Houghton, USA. Dr Shyam Murty Gupta and Dr O. S. Chauhan received the National Mineral Award of the Ministry of Mines, Government of India, for 1995 for their contributions in Marine Geology. Dr Gupta's contribution was in the field of micropaleontology & paleoceanography while Dr Chauhan's contribution was in physiography, tectonics and sedimentary processes.

Highlights of group-wise R&D activities of the institute:

Contract Services

The institute provided services in the form of consultancy for pre-feasibility studies and in the form of contracted data collection and analyses for full marine environmental impact assessment reports. The earnings accruing from these services showed an increasing trend and the earnings in terms of commercial rupees crossed Rs 110 million showing an increase of 22% over that in 1995-96.

Keeping in view the increasing industrial activity in the Gulf of Kutchh, five projects were undertaken, some in the environmentally sensitive ecosystems of corals and mangroves. The cumulative data sets from different surveys in the area will be used to compute the additive effect from contiguously situated industries and make suggestions for effective monitoring and mitigation measures.

The first dollar earnings from the Indian Oil Corporation (IOC) for environmental services emphasized the wider economic forces at play and the fine job the institute did in this project was an encouraging indicator that marketing such services further afield may prove profitable. The Gas Authority of India has utilized NIO's core competence in geophysical research in a proactive mode. With increasing pressure to remain commercially competitive, this project is a showcase of collaboration between a research lab and industry.

Coastal Environment

Environmental Impact Assessment -- The possible environmental impact of shallow water mining of placer deposits off Chavara (Kerala) was studied.

For assessing the impact due to effluent discharge from a chemical industry and jetty construction in two locations in the state of Gujarat, sampling was done at Kharach and Positra. Analysis of 22 samples from 11 stations showed the concentration of zinc 2.2 - 5.0 $\mu\text{g/g}$ and cadmium 0.06 - 0.07 $\mu\text{g/g}$.

Also, the Pulicat backwaters and Ennur estuary were found to have high values for phosphate and ammonia during low tide. The southern arm of the estuary appeared polluted in general due to the discharge of effluents from industries.

Coastal Ocean Monitoring and Prediction System -- Under this long-term programme funded by the Department of Ocean Development, observations were made at eight transects between Mormugao and Mangalore. The observations included salinity, dissolved oxygen, suspended particulate matter and concentrations of heavy metals, viz. Cd, Pb and Hg.

Samples collected at transects off Goa, Ratnagiri, Malvan, Karwar and Mangalore were also analyzed for Cd, Pb and Hg. The suspended particulate matter (SPM) values were low in general (<30 mg/l) except at Zuari possibly due to resuspension of sediments during low tide.

Among the zooplankton species, copepods dominated and the density of benthic organisms were highest at Calicut and lowest at Kasargod. The heterotrophic bacterial population showed a high incidence in sediments, indicative of the nutritional status of the ecosystem. Among the indicator bacteria group, only coliforms occurred regularly suggesting the faecal contamination of the area.

The nearshore Mumbai waters have been found to sustain a rich and diverse zooplankton fauna. Continuous observations for a period of 15 months indicated peak production of zooplankton during the postmonsoon period and high production of phytoplankton during the monsoon period average cell count ($28 \times 10^5 l^{-1}$). Of the forty two species, *Acartia spinicauda* dominated the copepod community. Four species of chaetognaths were found in the area with predominance of *Sagitta bedoti*. Among the penaeid larvae, *Metapenaeus affinis* was the most common species. Population of omnivores dominated the zooplankton community. This appears to be partially influenced by the high fluxes of anthropogenic pollutants reaching the coastal waters from the interior creek system.

Hydrobiological studies in the Gautami - Godavari estuarine system showed that 20% of inorganic phosphate and total phosphorus were added to the estuary during the pre- and post-monsoon seasons. However, during postmonsoon period, total nitrogen showed a near conservative distribution while geo-

chemical processes removed 13% of nitrate. During the postmonsoon period, phytoplankton counts were higher in the estuarine region than in the coastal regions, whereas a reverse trend was observed in the premonsoon period. Based on the mixing characteristics and flow pattern, the estuary behaves as: (i) well stratified during NE monsoon, (ii) moderately stratified in postmonsoon, and (iii) partially mixed in premonsoon seasons.

Biodiversity and Biomedical Potential -- Twenty-eight species of planktonic foraminifera were recorded from 46 plankton samples collected from 27 stations of 5 traverses along the Kerala coast.

Studies were made of species diversity, abundance and distribution of hydromedusae from different estuarine systems of the west coast of India. Maximum species diversity (345 species) was observed from Mumbai harbour and Thane Bassein estuarine complex. Cochin backwaters had 22 species and Baypore estuary had only six species. In diversity of the population, Baypore estuary ranked first. *Blackfordia virginica*, *Eutima commensalis*, *Eirene*

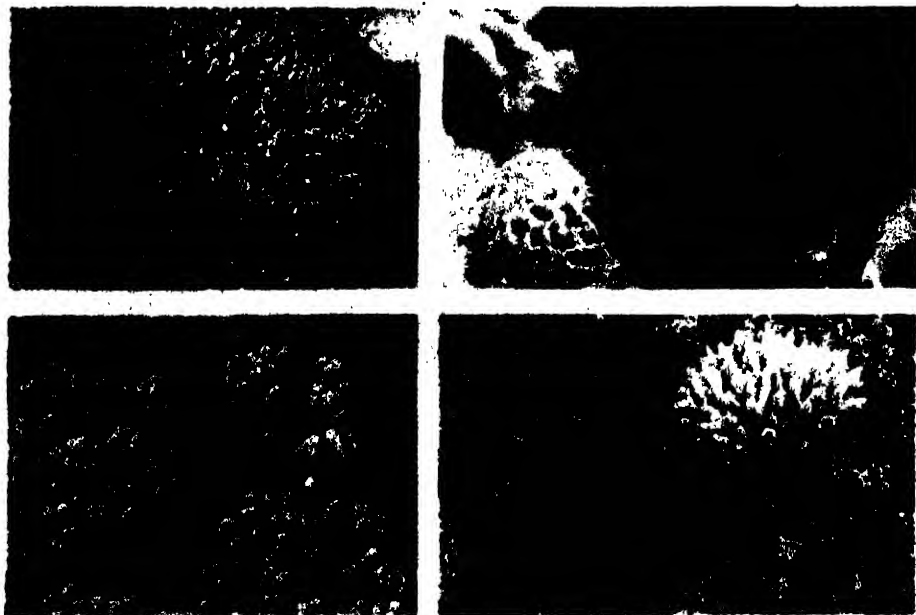
cylonensis, *Phialidium hemisphaericum* and *P. brunescens* were the commonly occurring species. *Ostronovia inkermanica* was recorded from Mumbai estuarine system. Salinity was found to be the limiting factor for the growth and activity of hydromedusae.

Investigations on the national project for development of new and safe drugs from the marine environment were continued. Major emphasis was laid on the isolation of active constituents from a mangrove (NIO-450). Fifteen new extracts and earlier promising fractions were sent to participating laboratories for testing for specific activities. The crude methanolic extract of Mangrove (NIO-497) exhibited antibacterial activity. Two compounds K006 and K007 (flavonoids) isolated from the active fraction have shown antibacterial activity at 30 mg/ml concentration against six bacteria.

Two sponges were studied and found to contain C_{27,29} mono and diunsaturated sterols. One of them in addition contained cholest-4-ene-3-one also. Butyl alcohol, its higher homologue and a heteroaromatic acid, 4 methyl-pyrazole 3(5) carboxylic acid have been identified. The nucleoside from one species was found to be antiviral and identified as spongoadenosin or Ara-A.

Offshore Explorations in Poompuhar Waters -- Underwater explorations off Poompuhar revealed the presence of a few stone blocks at various water depths. Airlift operations revealed the presence of several stone blocks in deeper sediments.

Further exploration of a shipwreck off Poompuhar showed a wooden hulled ship with surface badly damaged by borers. A large number of lead ingots found there indicate that the ship of Danish nationality possibly belonged to another East India Company.



Marine organisms screened for bioactivity



Engineering, Techniques & Technology

Design Methodology for Coastal Structures -- Pre-feasibility study for construction of a jetty at Ambolgarh, based on the available data on wave climate, tides, long-shore currents, sediment transport and a site visit, was carried out. Similar studies were also done for dredging of river mouths at Chapora, Sal, Saleri, Talpona and Galjibag along the Goa coast. Along the east coast, studies on the effect of dredging to improve the salinity of the Chilka lake and better water exchange with the sea were carried out. Locations for sea water intake and warm water discharge for the proposed power project near Dabhol port (Maharashtra) were identified.

Directional wave measurements made in 15 m water depth off Nagapattinam during the monsoon and fair weather seasons indicated that the spreading parameter could be estimated from the significant wave height and period corresponding to maximum spectral energy without relating to wind conditions. The unidirectional spectra can be modelled using the Scott spectra.

Wave direction has for the first time been consistently, accurately and unambiguously evaluated from array measurements using phase/time/path difference methods in case of polygonal arrays and in case of linear arrays. Time series measurements of water surface elevation at a 15-gauge polygonal array have been used in approximately 8 m water depth, operational at the CERC's Field Research Facility (FRF) at Duck, North Carolina, USA. The modifications made in the methodology are: Using the true phase instead of the apparent phase

and registering the estimates of wave direction only if the relevant gauges are coherent at 0.01 significance level. PTPD methods assume that in a spectral frequency band, the simple and expedient waves approach from a single direction and provide redundant estimates of wave direction. The observed estimates of wave direction are in agreement with the results obtained by the FRF using the sophisticated iterative Maximum Likelihood Estimation method.

Instrumentation -- Two autonomous Meteorological Data Acquisition Systems for the coastal research vessel of the Department of Ocean Development have been designed and installed on RV *Sagar Paschimi* and RV *Sagar Purvi*. The system is based on Motorola 68332 data logger to acquire surface meteorological parameters such as winds, air temperature, barometric pressure, solar radiation and relative humidity.

Remotely Operable Sea Skimmer (ROSS) is an autonomous unmanned vehicle designed for use in bathymetric surveys in coastal and estuarine environments. In ROSS version 1, developed at the IIT Chennai, the vehicle is a standard catamaran hull fitted with stabilizing skegs. In a second patented version developed at NIO, the hull is made from a free flooding HDPE tube enclosing 3 buoyant sealed bins containing batteries and electronics. A detachable aluminium frame bolted to

a welded rib on the outer hull carries two brushless DC thrusters. Both versions are equipped with a GPS (Global Positioning System) to measure position on the sea surface. The project is an ongoing collaborative venture involving NIOT Chennai, IIT Chennai and NIO, with funding from the Department of Ocean Development, New Delhi.

PVC protective wells for air-acoustic sea level gauges were fabricated and supplied to the Survey of India under the SELMAM project. These wells were installed at the ports of Mormugao, Chennai and Port Blair during April-May 1996.

Biofouling & Corrosion -- Studies to explore and develop anticorrosion formulations were made using a marine sponge. The aqueous extract of this organism at 1.5 mg/ml



ROSS (autonomous unmanned vehicle) for bathymetric surveys to complement manned survey vessels in hazardous environments.
ROSS 1 (Top) and ROSS 2 (Above)

concentration was found adequate to produce a passive steel surface. The inhibition mechanism was studied by gravimetric and potentiodynamic techniques.

Aquaculture -- A pilot scale prawn hatchery and aquaculture facility with modern amenities has been established, under the Technology Mission Mode Project on "Semi-intensive Prawn Aquaculture" funded by the Department of Biotechnology. The hatchery has an annual production capacity of 2 million post-larvae. The system is found to be efficient in breeding and culturing giant freshwater prawn *Macrobrachium rosenbergii*.

Techniques for culturing larval stages of *Penaeus merguensis* have been developed and perfected. Techniques have also been developed and standardized for mass culturing of phytoplankton species and *Artemia nauplii* as prawn larval feed.

A field laboratory has been established at Balramgari, Orissa. Three rearing ponds (30 x 6 m) have been constructed for culturing horse shoe crab under captive conditions. This will ensure the sustainable supply of the raw material for the preparation of a diagnostic reagent (LAL).

Knowhow has been developed to prepare seaweed extract as biofertilizer to be used in agriculture and horticulture. The knowhow has been transferred to M/s Pralsher Bio-products Ltd, Curchorem, Goa, for commercialization. The product is marketed by the firm under brand name PLANTOzyme.

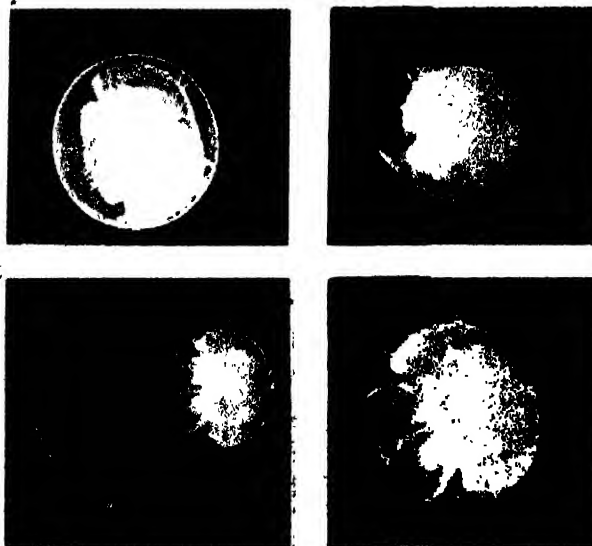
Offshore Processes & Resources

Physical Processes in the Tropical Indian Ocean -- The XBT data collected along the Mumbai-Mauritius shipping route during 1992-1996 under the TOGA-I XBT programme were analyzed for the determination of seasonal upper layer (0-760 m) thermal structure, heat content and zonal flow patterns. The analysis further revealed the presence of a narrow equatorial flow between 2°N and 2°S persisting for the whole year apart from the other current systems of the tropical Indian Ocean. The equatorial flow exhibited semi-annual cycle with a mean westward transport of 19 Sv during February-July and a mean eastward transport of 22 Sv during September-February.

Hydrographic data collected from 3 - 10 September 1996 along two transects, one along 18°N and the other along 90°E, were utilized to examine the thermohaline circulation and chemical properties of the Bay during the withdrawal phase of the SW monsoon. The

wide scatter in T-S values between 100 and 200 m was attributed to the presence of the Arabian Sea High Salinity Watermass (ASHSW). Though the warm and low salinity conditions at the sea surface were conducive for rise in the sea surface topography at 18°N, 87°E, the dynamic height showed a reduction of 0.2 dyn.m. This fall was attributed to thermocline upwelling noticed at this location. The net geostrophic volume transports were found to be of the order of 1.5 Sv towards the north and of 6 Sv towards the west across the 18°N and 90°E transects respectively. The surface circulation patterns were also investigated using the trajectories of drifting buoys deployed in the eastern Indian Ocean around the same observation period. Poleward movement of the drifting buoy with the arrival of the IMC to about 12°N along the eastern rim of the Bay was noticed in early October. The presence of an eddy in the SW Bay and the IMC along its southern periphery was also evident.

The biogeochemical significance of Transparent Exopolymer Particles (TEP) in the ocean was studied under the JGOFS programme. Concentrations of TEPs were higher in the Arabian Sea than in the Bay of Bengal. TEP concentrations were higher in the upwelled surface waters of the Arabian Sea. The availability of nutrients triggered intense biological production leading to enhanced release of extracellular material. Very high concentration of TEPs were found at ~ 600 m at 18° and ~



A few stages of laboratory hatched horse-shoe crab (incubation- 29°C)

20°N where upwelling occurred. Such concentration gradients were not seen in the Bay where TEPs varied within a narrow range. Decreased levels of TEPs coincide with higher secondary nitrite and nitrate deficits suggesting the involvement of TEPs in bacterial respiration/production in denitrifying layers. Despite the negative relation between TEPs and nitrate deficits, an average TEP concentration of $\sim 10 \text{ mg l}^{-1}$ persisted in the Arabian Sea oxygen minimum zone. This reveals that TEPs provide more than enough organic carbon to sustain bacterial activities in these denitrifying layers. Consequently, this carbon pool of TEPs may account for the hitherto unknown 'carbon substrate' required to meet the bacterial demand in subsurface layers of the Arabian Sea.

Opposing trends were observed in the isotopic composition of ^{15}N and ^{18}O of N_2O in upwelled waters with modest departures from the tropospheric values indicating that the ocean-atmosphere exchange cannot counter inputs of heavier isotopes associated with the stratospheric back flux, calling for additional sources and/or sinks of N_2O in the atmosphere.

Studies on the mechanisms of N_2O production in the upwelling zones preclude nitrification as the major process responsible for N_2O production. High concentration of N_2O and partial pressure of CO_2 (up to 62.5 nM and 700 $\mu\text{ atm}$ respectively) were off SW Indian coast during summer monsoon. These are the highest recorded for any oceanic surface waters. This reinforces the view that the coastal eastern boundary upwelling serves as significant source of greenhouse gases, particularly N_2O .

Abnormal variations in a CTD profile were noticed in the Andaman Sea during SK 118 cruise. The temperature fell by 4°C while the salinity decreased by 0.35 psu at 100 m depth at $10^\circ 30'\text{N}$, $93^\circ 15'\text{E}$ within about 2 h. Sound velocity also decreased by 10 m.s^{-1} at this depth. The $24.0\sigma_t$ isopycnal surface shoaled from 120 m to 90 m. An unexpected minimum in dissolved oxygen (34 $\mu\text{mol/l}$) and a peak in silicate (36 $\mu\text{mol/l}$) were noticed at this location. The above features could be due to a soliton or a fast moving cold-core sub surface eddy.

Paleomonsoonal history of the last 2500 years has been reconstructed by studying a 170 cms long shallow water (22 m) sediment core collected near the mouth of the Kali river. River influx intensity was inferred from planktonic foraminiferal and angular asymmetrical morpho-group of benthic foraminiferal abundances. The rate of sedimentation was determined from radio carbon dating. The downcore variation of the above parameters show that the Arabian Sea witnessed increased precipitation around 1705 AD and 300 BC and dry climatic conditions around 1565, 1355, 1075 and 305 AD. Interestingly, these periods, coincide with archaeological events and records in ancient scriptures (e.g. Akbarnamah) describing higher rainfall and famine periods.

A ferromanganese crust dredged from the summit of the Afanasiy-Nikitin seamount in the North Central Indian Ocean (NCIO) had recorded Neogene oceanographic events. The substrate of the crust is composed of fresh water phreatic calcite cement, *Terebratulinae* casts, rounded ferruginised basalt clasts and weathered coralline algal fragments and has provided evi-

dence that the area was exposed to subaerial conditions during the Oligocene ($\sim 30 \text{ Ma}$). The mineralogy, major trace and REE element geochemistry and co-model age estimates show the following three distinct accretionary environments during the crust growth: (i) a period of contemporary precipitation of Fe-Mn oxide and carbonate fluor apatite (CFA) in intermediate water oxygen minimum zone (OMZ) in the late Miocene; (ii) a pulse of highest CFA precipitation and detrital input in addition to Fe-Mn oxide accretion at the close of Miocene reflect most intense OMZ and erosion of Himalaya, and; (iii) an improvement in the oxidizing condition of ambient water owing to contraction of the late Miocene OMZ facilitated an accretion of pure Fe-Mn oxide during Pliocene and later.

Geology & Geophysics -- Continued studies on neotectonic activity over southern part of ECMI with high resolution sparker data along two E-W trending lineaments off Madras and Nagapattanam provided evidence of recent tectonic activity.

Inversion of magnetic data along 40 profiles of the eastern margin between Visakhapatnam and Paradip indicates: (i) a shallow and highly faulted basement in the innershelf; (ii) a NE-SW ridge trough configuration in the midshelf; (iii) transition from continental to oceanic basement at the foot of the continental slope; (iv) NW-SE basement upward off Bhimunipatnam to Kalingapatnam, and; (v) N-S basement trend off Chilka lake.

Crustal evolution of the Bay of Bengal -- Bathymetry, magnetic, gravity and multi-channel seismic reflection data acquired in the Bay of Bengal and in the distal Bengal Fan have thrown more light on

break up of India from eastern Gondwanaland and the post-break up events of the northeastern Indian Ocean. The trend of the fracture zones, the location of the major magnetic chron 34, and the Cretaceous Magnetic Quiet Zone suggest that Greater India separated from Antarctica in the early Cretaceous (i.e. polarity chron MO 120 Ma) and drifted northwestward. Magnetic reversals and northward trend of the 85°E Ridge support a hotspot origin of the ridge and that its emplacement took place probably after the Cretaceous quiet period.

The calcareous deposits on the western shelf of India off Bhatkal, at 50-58 m depth occur as crusts, sheets, cylinders and reddish brown mudstones. This indicates that the particulate matter in the calcareous deposits were initially at the proximity of the coast and cemented by metastable calcites during the Pleistocene interglacial sealevel stands on the shelf. Pedogenic cementation process overprinted and developed

them into eolianites and paleosols during the subsequent Late Pleistocene sealevel regression.

Genesis of apatite in the phosphatised limestones on the western continental shelf of India was studied. The apatite microparticles often adhere to clays and resemble fossilized bacteria hapetites. It appears that abundant flux was transported to the shelf at about 8,300 years B.P. which filled the pores/cavities of corals and coralline algae. Subsequently, microbial organisms colonized the sediment and filled pores of the limestones and favoured rapid precipitation of apatite locally by utilizing organic phosphate and phosphate adsorbed on to clays. Phosphatization of the limestones is thus a short event in the Early Holocene influenced by microbial processes.

The Indian Deepsea Experiment (INDEX) in the Indian Pioneer Area was initiated in 1995 to assess the possible environmental impact on the marine ecosystem owing to seabed mining in the Central Indian Basin (CIB). Multi-disciplinary studies on geological, biological, physical and chemical aspects were undertaken for establishing the baseline conditions in the CIB area prior to the benthic disturbance. The test and reference areas, were identified for the benthic disturbance experiment using close grid bathymetric surveys and nodule abundance data. Detailed geochemical, sedimentological, biological, and geo-technical studies on sediments resulted in understanding the benthic conditions and the distribution of macro, meio and micro fauna.

High-resolution shallow seismic reflection data obtained from the continental shelf sediments off western India from 10°N to 22°N reveal the anomalous seismic signatures in the form of acoustic maskings of methane-rich horizons. A conservative estimate of the potential subsurface methane in these gas-charged sediments is of the order of 2.6 Tg, and its contribution to the atmosphere with an annual flux of 0.039 Tg CH₄ appears to be quite significant. High seepage of methane from the seabed of the continental shelves should hence be considered for while estimating global oceanic flux of methane.

The Central Indian Basin (CIB) was considered to be inactive in terms of volcanic eruptions in the recent past. On detailed investigation of 27 sediment samples from CIB, two samples occurring at the base of an intraplate seamount were found to have high concentration of volcanogenic hydrothermal material (vhm). The vhm consist of ochrous metalliferous sediments, nontronite, volcanic spherules and glass shards. The metalliferous sediments are akin to their counterparts in the active hydrothermal sites in the Pacific Ocean in terms of colour, chemistry and formation. The volcanic spherules which are dominantly magnetite and resemble extraterrestrial spherules are products of liquid immiscibility of a silicic basic magma or of hydrovolcanic activity. Based on the age of the associated radiolaria with the vhm, an age of ~ 10 ka is suggested for an episode of volcanic-hydrothermal activity in the CIB. The present finding might have relevance for the type and eruptive mechanism of seamounts and the addition of elements to sea water and manganese nodules and crusts in the CIB. □

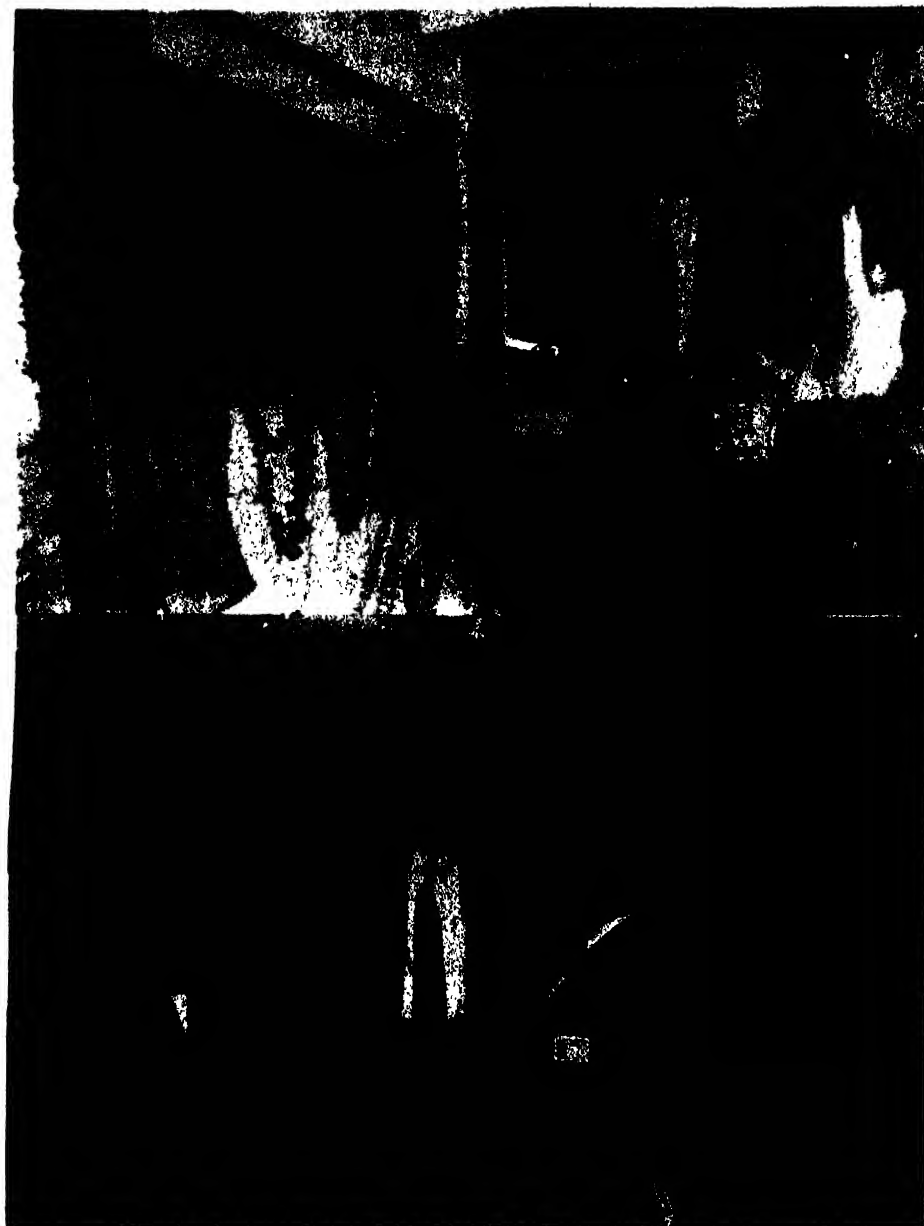


Terrestrial lime stones from continental shelf off Bhatkal: (a) dune - associated calcrete and (b) rhizoliths (calcified roots)

Foundation-stone of the Animal House at the Gheru-Campus, ITRC laid by the DG, CSIR

THE Foundation-stone of the Animal House at the Gheru Campus of Industrial Toxicology Research Centre (ITRC), Lucknow, was laid by Dr R. A. Mashelkar, Director-General, CSIR, on 27 December 1997.

Dr Mashelkar also inaugurated the newly constructed Silver Jubilee Block which houses the Administrative Section, Library and Toxicology Information Centre, and laboratory facilities for research in modern areas of toxicology such as molecular toxicology, *in vitro* toxicology and biotechnology. Visiting the Administrative Section with modular set up, he expressed satisfaction at the arrangement and facilities provided to the staff. While visiting the newly set up Toxicology Information Centre which includes Library and Toxicology Data Unit, he was told about the various toxicology databases available at ITRC, viz. TOXLINE, CHEMBANK, POLTOX, POISIN-DEX, etc. He enquired about the specific information content and the frequency of updating the various toxicology databases, the type of toxicology information services disseminated and the interaction with local information centres. He also enquired about the number of toxicology journals subscribed and their Impact Factor. He appreciated the compilation of the comprehensive bibliography on mercury containing 4000 references under the NTPC sponsored project, and ITRC's efforts in the popularization and use of Hindi through publications and seminars.



Dr R.A. Mashelkar, inaugurating the Silver Jubilee Block at the Main Campus of ITRC and visiting the Toxicology Information Centre, ITRC

Dr Mashelkar, in his address, stressed the need for updating the knowledge on toxicology front and advised to focus research on the current burning problems related to toxicology and environmental pollution. He said that while browsing Internet, he came across a large number of environmental chemicals

causing rise in environmental steroids which may have antiestrogenic activity leading to infertility in animals including man.

Dr Mashelkar took keen interest in the model and the layout plan of the proposed Animal House with a plinth area of approximately 2000 m². He was informed that the Ani-

mal House will meet the GLP requirements to cater to the needs for toxicological research and testing.

Dr Mashelkar said that the establishment of an ultramodern Animal House meeting international standards in quality with all GLP facilities will greatly enhance R&D activities at ITRC and its interaction with industry for safety evaluation and analytical toxicity testing of industrial products. He further said that ITRC has achieved two important milestones in the 25 years of its existence, viz. the Foundation Stone of the Animal House in Gheru Campus and the Silver Jubilee Block in the Main Campus. He expressed the hope that with new laboratory facilities, the institute will be able to undertake R&D in modern areas of toxicology.

Referring to India's population problem and environmental pollution, Dr Mashelkar said that ITRC has great potential and important role to play in the area of toxicology

and safeguarding the human health and environment. He advised the scientists to pursue high quality marketable research and accept new challenges in the field of industrial and environmental toxicology. He said that the CSIR support for new Animal House and laboratory facilities speaks of its faith in ITRC. He promised to extend CSIR'S full support for the growth of ITRC.

The distinguished guests who spoke on the occasion included: Dr P.M. Bhargava, Former Director, CCMB, Hyderabad; Prof. Indira Nath, Head, Department of Biotechnology, AIIMS, New Delhi and Chairperson, ITRC Research Council; Dr Nitya Nand, Former Director, CDRI; and Dr R.C. Simal, Former Director, ITRC.

Dr P.N. Viswanathan, Deputy Director, ITRC, proposed the vote of thanks.

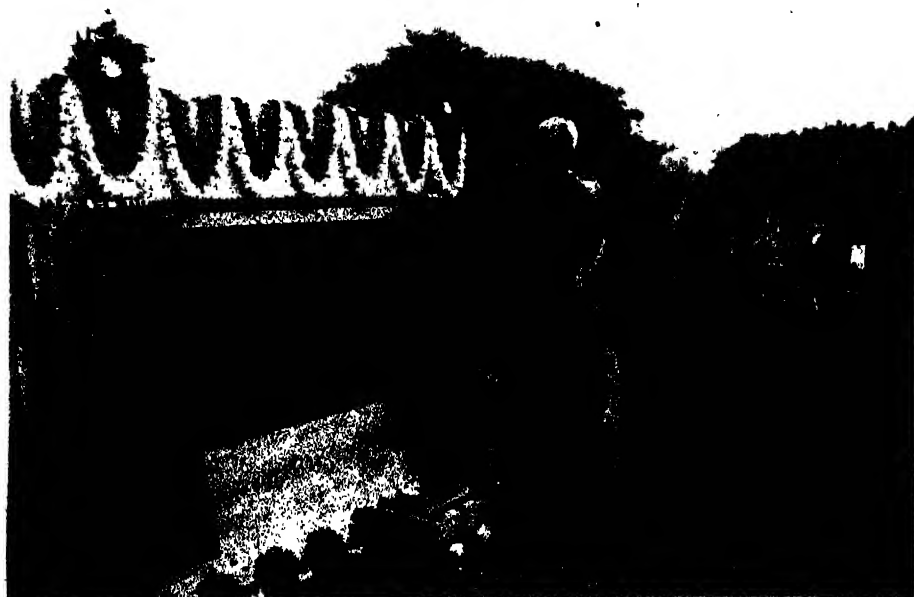
Earlier, Dr P.K. Seth, Director, ITRC, in his welcome address highlighted the recent R&D achievements of ITRC, National Mission

Programmes, National Coordinated Programmes and Consultancy and Collaborative Projects undertaken and completed by ITRC. He referred to the recent initiatives undertaken to further strengthen the research activities in molecular biology, immunology and biotechnology in the institute. Dr Seth referred to the growing interaction between industry and ITRC through environmental impact assessment and environmental audit studies. A major multidisciplinary programme on risk assessment owing to environmental mercury build-up in Rihand has been completed as a sponsored study of NTPC, informed Dr Seth.

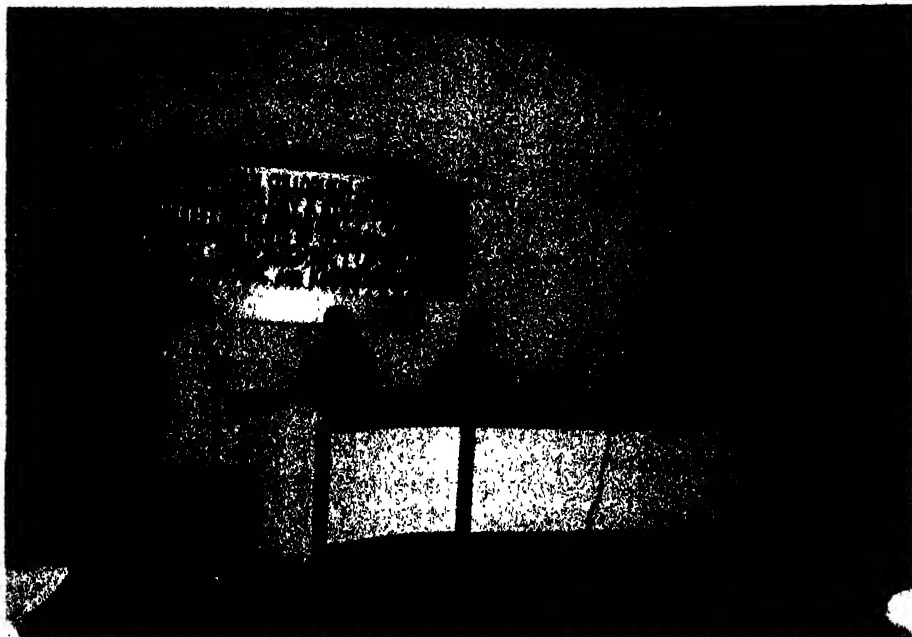
Dr Seth assured the Director General and other guests that ITRC is committed to use its knowledge-base on industrial and environmental toxicology in protecting the environment and safeguarding the human health.

Colloquium on Micropalaeontology & Stratigraphy

THE 16th Indian Colloquium on Micropalaeontology and Stratigraphy was held at the National Institute of Oceanography (NIO), Goa, during 22-24 January 1998. Over 200 researchers from various institutes and universities all over the country, including a few from UK, Norway and Australia participated in the deliberations which were spread over 16 sessions. A total of 161 abstracts of research papers were presented. Eminent scientists such as Profs. M.S. Srinivasan (Banaras Hindu Univ.), Ashok Sahni (Panjab Univ.), M. S. Mannikeri (Karnataka Univ.), Malkan Hart (University of Plymouth, UK), and



Dr R.A. Mashelkar, laying the Foundation Stone of the Animal House at Gheru Campus of ITRC



Dr Muthunayagam delivering the inaugural address. Seated on his left are: Dr R. Nigam (Convener, NIO), Dr Ehrlich Desa (Director, NIO), Dr J. Pandey (GGM, ONGC), Dr S.N. Bhalla (AMU, Aligarh) and Dr Ch. M. Rao (NIO)

Drs U.B. Mathur (Dy. DG, Geological Society of India, Jaipur), P.C. Pandey (Adviser, Antarctic Study Centre), Chhaya Sharma (Birbal Sahni Institute of Palaeobotany, Lucknow), Shirley Margret (Australia), William Kendrick (Australia), and Desikachary (Madras Univ.) delivered guest lectures.

Dr A.E. Muthunayagam, Secretary, Department of Ocean Development, in his inaugural address pointed out that the ability to understand the past enables us to prepare for the future research in this field. The reconstruction of physical geography of the ocean provides insight

into marine evolution. The fossils throw light into the past, specially into the existence of huge creatures like dinosaurs. The unravelling and understanding the mechanics of all changes on earth is a major challenge before us, he stated. Dr Jagdish Pandey, Group General Manager, ONGC, Mumbai, presided and Prof. S.N. Bhalla, Aligarh Muslim University, Aligarh, was Guest of Honour.

The colloquium provided a platform to review the status of palaeontological research. □

TRAINING PROGRAMMES

Matt Glazes for Crockery and Tableware

MATT glazes differ from transparent glossy and opaque glossy glazes in having a mass of tiny crystals embedded in a glassy matrix. They are formed when a completely fused

glaze cools and part of it crystallizes out in the glassy matrix. The crystals must be so minute and regularly dispersed that the surface of glaze is smooth and velvety to touch. It should be possible to write on a matt

glaze with an ordinary pencil and then to rub the mark off with finger.

Matt-glazed crockery and tableware offer excellent properties like craze and chip resistance, abrasion resistance and chemical durability.

The Central Glass & Ceramic Research Institute's Naroda Centre, under the sponsorship of SIDBI, Ahmedabad, conducted a three-day training-cum-demonstration programme (22-24 December 1997) with a view to transferring the technology for production of matt glazes for crockery and tableware to the small-scale ceramic units in Gujarat. Four entrepreneurs from different units located at Naroda, Himmatnagar and Thangadh in Gujarat participated in the programme.

The programme comprised theoretical and practical demonstrations covering the following aspects: classification and properties of glazes; raw materials and effect of their contributing oxides as well as additives; compounding of matt glazes; glaze manufacturing processes; glaze application; glaze defects and their remedies. Shri Ajit Sahijwani, Manager, SIDBI, Ahmedabad, spoke regarding the role of SIDBI in the growth, promotion and development of small-scale industries in the country.

Dr K.N. Maiti, Scientist-in-Charge of the institute and leader of the project, inaugurated the programme and also delivered most of lectures during the T&D programme. The other faculty members were also drawn from the institute. Shri R.M. Savsani, Technical Officer, conducted the entire practical demonstration.

With the training received, the participants expressed their confidence in diversifying their product

line by producing quality matt glazed crockery and tablewares without any difficulty □

and alloys, improvement in performance of materials through metallurgical and tribological studies, and surface engineering. He has contributed significantly in solving

Training-cum-Demonstration Programme on Frits and Glazes

THE Central Glass & Ceramic Research Institute's Khurja Centre in the recent past conducted a Training-cum-Demonstration Programme for manufacturing frits and glazes for different type of ceramic products. The programme was organized on the request of M/s SVM Tea & Industries Ltd (STIL), Ankleshwar (Gujarat), with a view to implement the CGCRI know-how on frits and glazes in its existing unit at Ankeleshwar. Shri Hemant A. Thakker, Production Manager of STIL (Ceramic Frit Division), attended the programme. The programme comprised theoretical lectures and practical demonstration covering the following aspects: Basic raw materials and their characteristics for preparation of frit batches, melting in pot furnace,

grinding of frits in pot mill and their use in different glazes, glaze defects and their remedies, testing and quality control, etc. Different type of frits were also discussed in detail. The emphasis was laid on greener technologies. □

HONOURS & AWARDS

Dr Amol Kumar

DR Amol Kumar Jha, Scientist, Regional Research Laboratory, Bhopal, has received MRSI Medal Award - 1998 for his distinguished R&D work in the areas of Metallurgy and Materials Sciences. Dr Jha's R&D interest includes basic and applied research for development of new materials



the material problems in various engineering sectors such as mining, agriculture, etc.

Material Research Society of India (MRSI), a Founding Adhering Body of the International Union of Materials Research Societies (IUMRS) and an apex interdisciplinary scientific body, promotes and recognises excellent R&D studies on materials all over the country.

Dr Jha was presented the MRSI medal, a certificate of excellence and a cash prize at the 9th Annual General Meeting of the Society held at IIT, Madras, during 11-13 February 1998 by Prof. S.K. Joshi, President of the Society.

Prof. T.C. Rao

PROF. T.C. Rao, Director, Regional Research Laboratory (RRL), Bhopal, has been awarded the prestigious Mining Engineering Design Award - 1997 under the National Design and Research Forum of the Institution of Engineers (India). Prof. Rao has also taken over as Chairman, M.P. Centre of Institution of Engineers (India). □



The Process for determination of Thermal Expansion of Frit is being demonstrated to the participants during T&D Programme on Frits and Glazes

ANNOUNCEMENTS

International Symposium on Information Technology in Oceanography

THE National Institute of Oceanography (NIO), Goa, is organizing an International Symposium on Information Technology in Oceanography (ITO-98) during 12-16 October 1998. ITO-98 aims to review application of Information Technology to Oceanography and identify areas of potential applications. It will bring information managers, ocean industry, scientists, researchers and academicians to a common forum where the use of Information Technology in Oceanography is the focus. Its objectives are to assess the requirements of end-users (scientists and industry) and to try means of IT to increase the efficiency and effectiveness of ocean industry.

The Symposium will focus on all aspects of Information Technology Applications, Management Information Systems, and Human Resource Management for IT Applications in Oceanography.

The ITO-98 proceedings has been divided into four major activities, viz. Plenary lectures, Technical sessions, Commercial/Corporate presentation, and Exhibition/Demonstration by the International Scientific Programme Committee (ISPC).

Plenary lectures will be delivered by eminent personalities on lead topics like Developments and Innovations in Marine Data Management (Dr Ben Searle, Director, Australian Oceanographic Data Centre, Australia); Your Screen -- a Window on the Oceans (Dr Paul Geerders, IOC Consultant, The Netherlands); Accessing Online Oceanographic Data/Information and Information Security in Distrib-

uted Processing Environment (Dr Parmesh Dwivedi, Chief Information & Systems Management Division, NOAA/NESDIS/NODC/USA); Oceanography and Marine Biodiversity (Dr Rainer Froesh, Project Leader, FISHBASE, ICLARM, Philippines); Library and Information Services in Oceanography (Prof A. Neelameghan, Hon. Executive Director, Ranganathan Centre for Information studies, Bangalore), and; Subsea Cyberspace -- Harnessing Computers for Under-water Communications (Dr Anand Parthasarathy, India). Some other lectures are by Prof. Yasuhiro Sugimori (President, PORSEC, Prof. Tokai Univ. & Chiba Univ., Japan), Dr Peter Pissierssens (Inter-governmental Oceanographic Commission, UNESCO, Paris, France) and Dr Ehrlich Desa (Director, NIO, India).

Technical sessions will have oral and poster presentations on the following subjects: Role of Libraries, Information Centers, Information Systems and Networks in Oceanography; Data Acquisition & Database Management, Information Management in Oceanography; Mathematical Modeling and Advanced Computer Simulation in Oceanography; Remote Sensing, GIS, Multimedia and CAD/CAM Applications in Oceanography; Expert Systems, Analytical & Forecasting Tools and Virtual Reality in Oceanography; Internet and Intranets in Oceanography; Underwater and Maritime Communication; Ocean Engineering & Instrumentation (Robotics, ROVs, ROSS and submersibles); Computer-Aided Learning and Management Information Systems

in Oceanography, and; Human Resource Development and Infrastructure Building in ITO.

Abstracts of not more than one page (A4 size) should be submitted by 30 June 1998.

For further details, please contact:
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E-mail: ito 98 @ darya. nio.org

ito 98 @ csnio.ren.nic.in.

HARI Om Ashram Prerit Shri S.S. Bhatnagar Research Award Endowment 1996 and 1997

THE Director, Central Salt & Marine Chemicals Research Institute (CSMCRI), Bhavnagar, invites applications from Indian citizens/teams who have carried out outstanding original research work in the field of: 1) Prevention of Water Pollution - 1996 (work period 1991 - 1995); and (2) Energy Conservation - 1997 (work period 1992-1996). There will be two cash awards of Rs 5000/- (First) and Rs 3000/- (Second) for each year's awards.

The rules, regulations and application forms can be obtained from the Director, CSMCRI, by sending a self addressed stamped envelope of size 26.5 x 11 cms. The last date for receiving completed applications is 30 June 1998.

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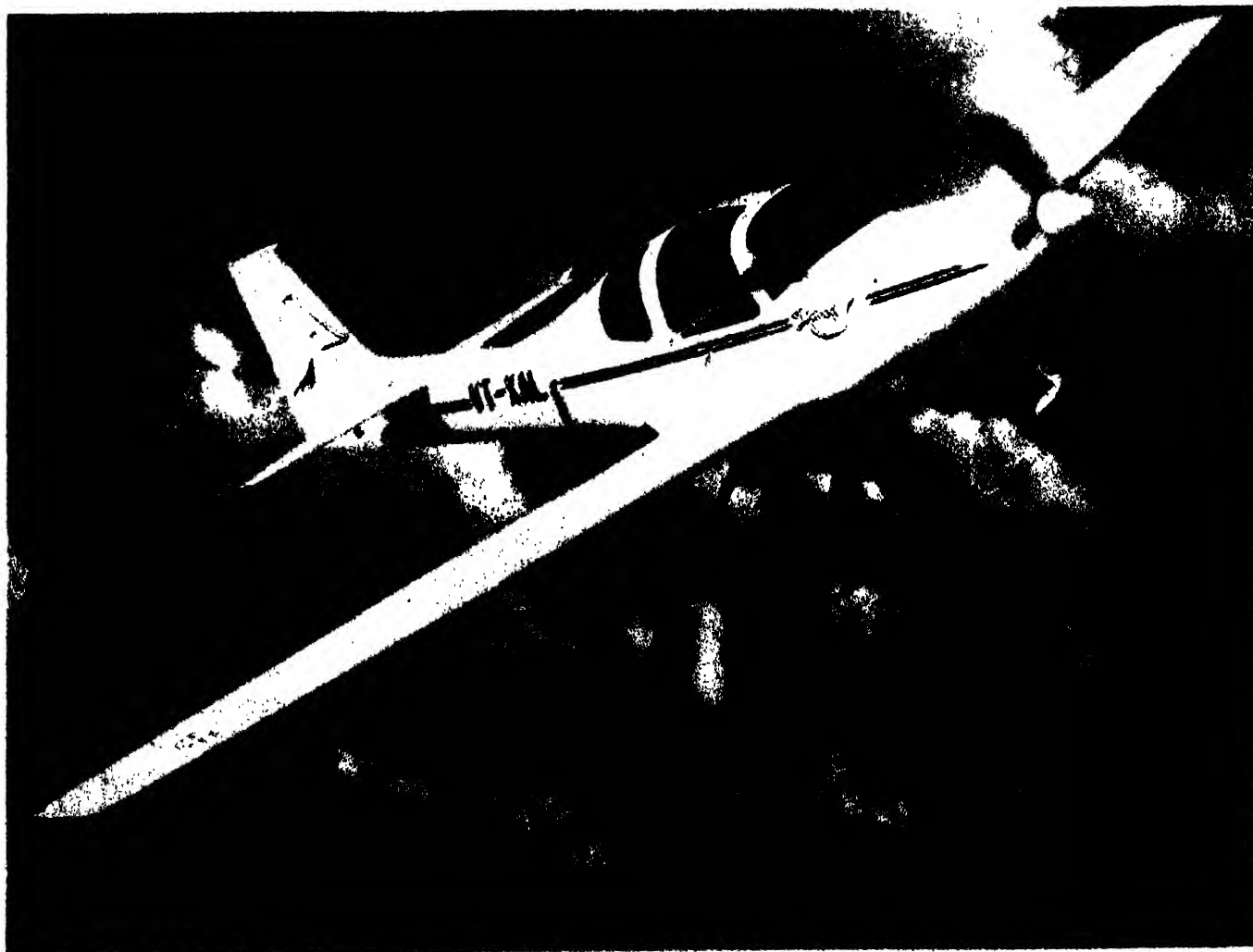
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CSIR NEWS

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Hansa-3—the ideal light aircraft for *ab initio* training, sport and hobby flying, developed, designed and fabricated by the National Aerospace Laboratories, Bangalore

HANSA-3 Based on NAL R&D Test Flown Successfully

THE National Aerospace Laboratories (NAL), Bangalore's programme to design, fabricate and test an all-composite trainer aircraft took a giant leap forward with the successful flight of the second prototype of HANSA-3 on 11 May 1998 shortly after 12.30 p.m. Dr Murli Manohar Joshi, Hon'ble Minister for Human Resource Development and Science and Technology, together with Shri Ananth Kumar, Hon'ble Minister for Civil Aviation, formally flagged off the aircraft. Dr R.A. Mashelkar, DG-CSIR and Directors of 40 CSIR laboratories, assembled at NAL for the CSIR Directors' Conference, were also present to witness the test flight.

Shortly before 1.00 p.m., the new HANSA-3 flew past the FED, Hangar three times, with Sqn Ldr Baldev Singh piloting the test flight and receiving a tumultuous applause.

The latest HANSA is 100 kg lighter than its predecessor and is powered by the superior Rotax

914F3 turbo charged engine. The engine can develop a maximum of 115 BHP at 5800 rpm. The aircraft has a cruise speed of 215 kmph. Special features of the HANSA-3 are: Glass/carbon reinforced epoxy structure; Laminar flow aerofoil

LS(1)-0415; Excellent visibility, and; Hydraulic brakes.

The successful flight of HANSA-3 signals that NAL is nearing the end of an ambitious project to design, develop, fabricate, test fly and certify India's first all-composite aircraft. Dr Joshi congratulated the HANSA team and commended its wonderful work spirit. "We are seeing the birth of an Indian civil aviation industry", he declared. Shri Ananth Kumar expressed his happiness at the success of the HANSA programme in his constituency. "We are fully behind this indigenous aircraft development effort", he said, adding that he himself might be a prospective buyer of a HANSA. Dr Mashelkar said that HANSA signified "the new spirit of Indian S&T".

The all-composite HANSA programme was launched by NAL in partnership with the Taneja Aerospace and Aviation Limited (TAAL)



Dr Murli Manohar Joshi, the Minister of Science & Technology, with the test pilot in the cockpit of HANSA-3 prototype II



Hansa-3 prototype II being piloted by Sqn Ldr Baldev Singh

around 1991. The first success of HANSA programme came in November 1993 when the experimental prototype, HANSA-2, flew on 23 November 1993. HANSA-2 has subsequently logged in 62 hours of incident-free test flying. Early in 1996, HANSA-2 was re-engined with more powerful Teledyne Continental IO-240B engine. The re-engined HANSA, named HANSA-2RE, first flew on 23 January 1996 and has now completed 106 hours of test flying. The first prototype of certification version (HANSA-3, proto 1) powered by the 125 HP IO-240B continental engine, flew in November 1996 and participated in display flying at the international air show held at Bangalore during December 1996.

Efforts towards type - certification truly began with HANSA-3 prototype 1. The all-up weight of the prototype 1 was 850 kg. In order to stay within the frame work of JAR-VLA route for certification for small aircraft, decision was taken in April 1997, to build a second prototype with a reduced all-up weight not exceeding 750 kg, bringing about additionally higher performance compared to the prototype 1. The targeted weight reduction, a truly challenging task, was carried out without change in the composite raw materials, partly with a careful redesign of the entire structure and partly with the use of a new light weight, high-tech power plant, the Rotax 914F3.

The second prototype is anticipated to get JAR-VLA type-certification under day VFR category by August 1998. After type-certification, the design and know-how in fabrication will be transferred to the TAAL for regular series production.

Initially the aircraft is expected to enter the flying schools in the country for pilot training. There is a significant market, domestic as well

as export, for other roles such as surveillance, aerial photography, environmental monitoring, etc. □

NAL Plans for Vibrant Indian Civil Aviation Industry

CIVIL aviation is to play an increasingly important role in the Indian economy in the years to come. During the next 20 years, India is expected to spend Rs 700,000 million for aircraft acquisition alone. Additionally, there will be huge investments on airport infrastructure, ground operations, maintenance facilities and training. This anticipated quantum leap constitutes a wonderful opportunity to nurture, establish and promote a vibrant civil aviation industry in India by preventing a huge outflow of money from the country, and also to act as a significant wealth generator for India. National Aerospace Laboratories (NAL), Bangalore's initiatives in this direction include two major programmes involving the design and development of small aircraft – the HANSA and SARAS programmes – as well as a series of other programmes to develop airport instrumentation systems, black box readout systems, pilot guidance systems, studies on structural integrity of aging aircraft and metallurgical failure analysis.

NAL's light aircraft development attained its first milestone with the successful fabrication and flight of Light Canard Research Aircraft (LCRA) in 1987. The confidence gained from this experience encouraged NAL to launch the HANSA programme for the design, development and fabrication of an all-composite 2-seater trainer aircraft. HANSA-3 (Prototype 2) has made

the successful test flight on 11 May 1998. Now, the first SARAS test flight for the more ambitious SARAS programme (14-seater multi-role light transport aircraft) is expected to be carried out by 1999 end.

To give a strong focus to its initiatives in civil aviation, NAL has set up a full-fledged Centre for Civil Aircraft Design and Development (C-CADD) in 1995. C-CADD has a fully equipped CAD Centre and is supported by a strong team of aircraft designers and consultants. NAL is now recognized by the Director-General of Civil Aviation (DGCA) as an aircraft design organization for the HANSA and SARAS programmes.

NAL has also undertaken a series of surveys to make appraisals of the growth and likely potential of an Indian civil aviation industry during the next decade. All these surveys predict a sweeping growth in all departments of civil aviation. NAL's confidence in its civil aviation programmes is bolstered by the wealth of experience which its laboratories have acquired while supporting the Light Combat Aircraft (LCA) programme: NAL has rendered very significant and wide-ranging support in the LCA development, notably in the areas of design and development of LCA fin, rudder and wings, wind tunnel testing of LCA models and development and validation of the LCA control law. □

NPL granted US Patent for Thalassemia Management Medicine

THE National Physical Laboratory (NPL), New Delhi, has for the first time in India, developed a process for the preparation of an oral iron chelating drug for treating patients suffering from thalassemia. The medicine has been developed by Dr A.K. Sarkar, Head, Chemistry Group, NPL, in



collaboration with a team of medical doctors. The work has been patented in the United States vide patent No. 5665,392 dated 9 September 1997.

Thalassemia is a dreaded disease among children caused by genetic disorders. It is actually a group of hereditary disorders with defective haemoglobin synthesis, characterized by hypochromia, microcytosis,

hemolysis and a variable degree of anemia. Thalassemia involves a heterogeneous group of molecular defects and is expressed with a wide spectrum of clinical symptoms. In case of Thalassemia (major), iron in the haemoglobin breaks down and gets deposited on the vital organs of the body, e.g. liver, kidney, spleen, etc. The life span of children suffering from Thalassemia (major), also known as iron overloading in the body, becomes unpredictable. Every year, out of 1,00,000 children born with Thalassemia major in the world, 10,000 are born in India.

The present invention relates to a formulation of iron chelation and is useful for treating Thalassemic children at a very low cost. The annual cost for treating Thalassemia using Disferal is US \$ 3000 - 6000 [CRG Critical Reviews - Clinical Lab Series, 26(4) (1988) 314], US \$ 800 - 1100 for Difriprone L.1 [New Review (UK) Thalassemia Soc, Issue No. 61, March 95]. The present formulation costs only US \$ 50-60 for the same treatment per annum. The medicine has to be administered orally and is free from any side effects. □

project is three years and the implementation cost is around Rs 4.1 million. Shri K.D. Padia and Dr J.S. Patolia, Scientists at CSMCRI, are the Principal Investigator and Co-investigator respectively.

Development of Electrodialytic Dissociation Process

The Ministry of Environment & Forests (MEF), Government of India, has sanctioned Rs 0.297 million to CSMCRI for the Development of Electrodialytic dissociation process to recover acid and alkali from industrial effluent salt solutions with Dr S.K. Adhikari, Scientist at CSMCRI, as the Principal Investigator. □

Molecular and Phenotypic Variation in *Bacopa monnieri* (Brahmi) Germplasm

A germplasm collection of *Bacopa monnieri* (Brahmi) has been built up at the Central Institute of Medicinal & Aromatic Plants (CIMAP), Lucknow, by a collection from North (U.P., Haryana, Punjab), West (Maharashtra), Central (Madhya Pradesh), South (Kerala, Karnataka, Tamil Nadu) and East (West Bengal, Assam) zones of India. The phenotypes and the chemotypes showed wide variation of traits like leaf size, pigmentation, flower colour, plant growth characteristics and bacoside content. RAPD profiles using twelve random primers (MAP01-MAP12) were investigated for four representative genotypes to estimate the genetic distance between them through the

New Projects at CSMCRI

Model Biovillage

THE Department of Biotechnology (DBT) has sanctioned the project 'Model Biovillage', at Mocha-Gorser village near Porbandar, to the Central Salt & Marine Chemicals Research Institute (CSMCRI), Bhavnagar. The pro-

ject aims at demonstration/extension activities of the established technologies of DBT, CSMCRI, CLRI and NEERI for RO plant, marine algae culture, cattle licks preparation, plantation on wasteland, biogas installation, use of biofertilizers and biopesticides, carcasses disposal and sanitation. The duration of the

DNA polymorphism. The RAPD analysis has been extended to all the accessions for assessing the extent of genetic variation in the collection and defining it into distinct clusters towards developing a representative 'core collection'. Methods have also been standardized for *in vitro* maintenance and rapid multiplication of the genotypes. It is anticipated that the studies will attract tremendous academic interest and help researchers in strengthening IPR issues. □

Molecular Distinction of a Robust Growth Variant of *Mentha arvensis*

THE randomly amplified polymorphic DNA (RAPD) of a robust halfsib selection (selection-3) from clonal population of variety HY-77 (Kalka) was compared with parent HY-77 and var. Shivalik of *Mentha arvensis* during studies made at the Central Institute of Medicinal & Aromatic Plants (CIMAP), Lucknow. Using four random primers namely MAP 03, 04, 05, and 12 of CIMAP's kit, AP-PCR established that selection-3 is more closely related to HY-77 than Shivalik. MAP 03 and MAP 12 showed 100% band similarity in RAPD analysis while MAP 04 and MAP 05 showed 0.62% and 0.80% band similarity indices, respectively. The phenotype of selection-3, showing a number of simultaneous changes with respect to the parental HY-77, seems to be the result of some spontaneous gross mutations due to which the field variant selection-3 might have originated.

New Externally-funded Projects at NML

THE externally-funded projects taken up by the National Metallurgical Laboratory (NML), Jamshedpur, in the recent past include:

- Characterization, beneficiation and extraction of vanadium and titanium from vanadiferrous and titaniferrous ores (DGM, Ranchi)
- Investigation of the premature failure of ESSAR back-up rolls (Essar Steel)
- Failure analysis of 6" dia inter gas header at LPG recovery plant (GAIL, Vijapur)
- Studies on sintering of iron ores (Bellary Steels)
- Beneficiation of waste dumps of M/s Trimex Agency Ltd, Madras, for recovery of feldspar, quartz and mica
- Production of super alloys, Fe Ni Cr, Fe Ni Co (VSSC)

- Study of metallic wastes (Ministry of Environment & Forests)
- Metal status of the soil, water and vegetables of Patamda (DST)
- Cyclic J Integral Evaluation of various nuclear grade carbon manganese steels (AEC)
- Textural development of AISI 316 austenitic SS during cold rolling and annealing (DST)
- Studies on silicon control of Indian blast furnace (CSIR)
- Development of an appropriate technology for traditional brass and bell metal artisans (DST)
- Salt roasting of sulphides (CSIR)
- Improvement in metal powder quality (ACME Metal Powder Pvt Ltd, Pondicherry). □

Selection-3 produces upright stems rising from the underground rhizomes and shows synchronous branching. The arrangement of branches is unique giving a globular canopy facilitating high sunlight capturing ability by the leaves and preventing fall of lower leaves. It is early-maturing (90-100 days). It has a high leaf:stem ratio (1.40) and high mint oil yield (35-40% higher than parent variety Kalka). □

Transfer of NML Technologies

THE National Metallurgical Laboratory (NML), Jamshedpur, has recently transferred two technologies, viz. Electroless Nickel Plating to M/s Saptharishi Metals, Alloys and Products Ltd, and Production of Ferro-Vanadium to M/s Gyan Ferro-metals Ltd, Jamshedpur. □

CSMCRI celebrates Foundation Day

THE Central Salt & Marine Chemicals Research Institute (CSMCRI), Bhavnagar, celebrated its 45th Foundation Day on 7 April 1998, the actual Foundation Day (10 April 1998) being a holiday, by organizing Foundation Day Lecture, and Exhibition entitled Ocean in Service of Mankind. The Foundation Day Lecture entitled Ocean our Last Frontier was delivered by Dr B.N. Desai, former Director of the National Institute of Oceanography. Prof. Vidyut Joshi, Vice Chancellor, Bhavnagar University, who inaugurated the Exhibition, graced the Foundation Day Lecture function as Chief Guest. Dr S.D. Gomkale, Acting Director, CSMCRI, presided over the function.

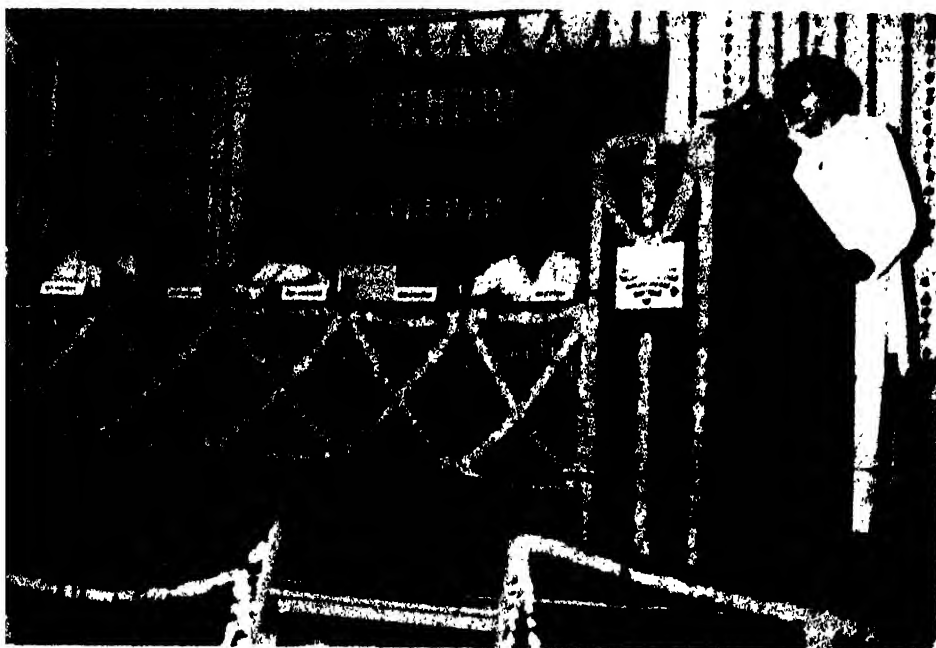
In his welcome address, Shri R.N. Vohra, Scientist and Chairman, CSMCRI Foundation Day Celebration Committee, traced the genesis of CSMCRI and introduced Dr B.N.

Desai. The Foundation Day Lecture dealt with formation of the Universe, ocean basins, sea water and physical processes occurring in oceans. Emphasizing ocean as Mankind's Last Frontier, Dr Desai said ocean provides us abundant oxygen by generating it through photosynthesis by the green pigment in the plants harboured by it and contributing towards maintaining oxygen level on the earth. Explaining the direct control of ocean on the climate of the earth, Dr Desai said temperature is highest near the equator and lowest near the poles owing to radiation of sun. This causes formation of winds from poles to the equator and vice versa enabling the earth to have climate varying in comparatively a narrow range. Further, monsoon is only spin-off of this wind formation. The rainfall is not constant over the years and varies in different seasons and different re-

gions. Explaining ELNINO effect and Pacific shift, he said that Ozone-hole phenomenon was first discovered in Antarctica and is found in the Arctic as well.

Describing food-richness of ocean in greater details, Dr Desai said it is a major source of protein. The fish in sea supply this important food material. The sea water has its own flora and fauna like land. Dr Desai said that in presence of sunlight, the green pigment in the water produces organic carbon which multiplies and forms the first step in the food chain primary producers. This leads to single cell and multi-cell plants with varying degree of green pigment with variation of blue and brown pigments represented ultimately in seaweeds. On the other hand, the animal life comes into existence in a unicellular or multicellular formation called zooplanktons. These phyto and zooplanktons occupy upper layers of the ocean and remain floating in the sea. Some of the organisms settle down on the sea-bed and lead benthic life. Thus, various invertebrate organisms are developed and the fishes are the ultimate organism in the sea water. These organisms when die, decompose and convert into basic nutrients owing to bacterial action. This entire process is known as Trophic Cycle, Dr Desai added. He then dealt with metals, chemicals and fresh water from sea.

In his concluding remarks, Dr Desai expressed grief over mankind's attempts to harm this heritage and pleaded for greater awareness about the importance of oceans and warned the civilization to desist



Prof. Vidyut Joshi delivering his address on the occasion of CSMCRI Foundation Day Celebrations. Sitting on dais (from right) are: Shri R.N. Vohra, Dr B.N. Desai, Dr S.D. Gomkale, and Shri C. Badrinath

from polluting it as oceans are the last frontiers on which it has survived and will continue to prosper.

Prof. Vidyut Joshi in his address emphasized importance of oceans and suggested that along with Environment Impact Studies (EIS), we should also take up Social Impact Studies (SIS). Unless this is done, he said, we would be heading towards half-hearted efforts and would be

unable to render justice to our heritage.

Dr S.D. Gorkale, in his presidential address, thanked Dr Desai for his illuminating talk on oceans. He also thanked Prof. Vidyut Joshi for accepting invitation to be the Chief Guest and accepted his suggestion of SIS. The CSMCRI, he assured, when takes up EIS will also simultaneously take up SIS. □

CBRI Golden Jubilee Celebrations

THE year long Golden Jubilee functions of the Central Building Research Institute (CBRI), Roorkee, concluded on 10 February 1998 with the celebration of 51st Foundation Day of the institute. On this occasion, Dr R.A. Mashelkar, Director General, CSIR, unveiled the statue of Pt. Jawahar Lal Nehru in the foyer of the main building and inaugurated the newly constructed guest house of the institute, named 'Golden Jubilee Guest House'.

The institute came into existence as Building Research Unit in May 1947 and started functioning in the premises of the University of Roorkee. The foundation stone of the Central Building Research Institute was laid by Shri Sri Prakasa, Minister of Natural Resources and Scientific Research on 10 February 1951. The opening ceremony of the building was done by Maulana Abul Kalam Azad, the then Minister of Natural Resources and Scientific Research. The Building Research Unit became full-fledged research institute having its own vast and beautiful campus. The then Prime Minister Pt. Jawahar Lal Nehru had graced both

the occasions namely foundation laying ceremony and inauguration of the new building by his presence.

The concluding function of the Golden Jubilee Year was presided over by Dr R.A. Mashelkar. Prof. M.M. Sharma, FRS, Former Director, Department of Chemical Technology, Bombay University, was the Chief Guest.

In his welcome address, Prof. R.N. Iyengar, Director, CBRI, briefly apprised the audience about the achievements of CBRI in the last five decades. He also touched upon the various problems faced by the staff of the institute and pleaded for better recognition for them.

A newly instituted annual award named 'Golden Jubilee Director's Award' for best paper published in a refereed journal was given to Dr Manjit Singh and Smt Mridul Garg. Another prize started by the family members in the memory of Late (Dr) R.B. Hajela — A former scientist of the institute — was given to Dr B. Singh, Smt M. Gupta and Smt Achal Verma.

Dr Mashelkar in his address felicitated the scientists and staff of CBRI for their excellent achievements, and exhorted them to do more hard work in the changed global scenario, as India has to play a leading role. Dr Mashelkar said that the equipment, machinery, brick and mortar do not show us the nature of an institution. Only the people who run it and the glow in their eyes tell us the real health of the institute. He further said, "here I see the real glow in the eyes of the scientists". Dr Mashelkar spoke highly about the work done by the institute regarding disaster mitigation in Uttar Kashi, Latur and Andhra Pradesh. CBRI has fulfilled its social commitments to the country by contributing to the improvement in people's life and by reducing their miseries during natural calamities. This is much more important than the revenue earned by the institute. We should be proud of being the member of CSIR.

Prof. Sharma delivered the foundation day lecture 'Role of Plastics in Buildings'. He emphasized that CBRI should take a lead in the utilization of plastics in buildings as they are corrosion resistant, environment friendly, high strength, light weight and real substitute to the wood. He particularly emphasized that recycled plastics should invariably be used in buildings. Plastics being light weight, high strength and semi-transparent, are better substitute of asbestos. All window & door frames can be easily made using plastics. Also glass panes can be replaced with plastics.

Dr N.S. Bhal, Deputy Director CBRI, proposed a vote of thanks. □

Seminar on Eco-friendly Rehabilitation of Degraded Mining Land

THE Central Mining Research Institute (CMRI), Dhanbad, organized a two-day national seminar on 'Eco-friendly Rehabilitation of Degraded Land of Mining Areas' in Hindi, during 17 - 18 April 1998.

Shri S.N. Padhi, Director-General of Mines Safety, DGMS, Dhanbad, who was the Chief Guest on the occasion, inaugurated the seminar.

Explaining the gravity of problems owing to unscientific mining in the past, Shri Padhi stressed on the proper identification of unstable areas and application of fast and effective technology for rehabilitation of degraded lands. He opined that effective solution to this serious problem requires proper co-ordination among state governments, central government, mining companies, research/teaching organizations and local people. According to him, responsibility for implementation of plans and programmes necessary for its effective solution should be entrusted to a particular organization.

Earlier, welcoming the distinguished gathering, Dr T.N. Singh, Chairman, Organizing Committee of the seminar and Director, CMRI, said, "As our land area is fixed and population is increasing at a very fast rate, damaging even a small patch of land is a sin. On the other hand, it is not practicable to stop mining activities. Our efforts should be to make a judicious balance between the two by resorting to eco-friendly mining so that damage to the land, water and air is minimum. Mining should be followed by programmes for reclamation and rehabilitation of lands, and restoration of flora and fauna".

Justifying the need for organizing the seminar in Hindi, he said, "This is a problem of the masses residing in the mining areas. So, a seminar on a topic like this should not be confined to scientists and academicians only and the participation of people from various walks of life is a must. As Hindi is understood by most of the people, it can carry the message to the masses ef-

fectively and motivate them which is necessary for effective implementation of such programmes".

At the end, Dr T.N. Singh presented a memento to the Chief Guest.

The Technical Sessions of the seminar were attended by about 90 delegates from different parts of the country. The participants were not only scientists and academicians but also people like journalists, environmentalists and engineers.

A total of 45 papers were presented during the two day deliberations. As suggested by Shri S.N. Padhi in the inaugural function, an open session was arranged for discussions on the report of Bagchi Committee on Subsidence and Fire in Mines.

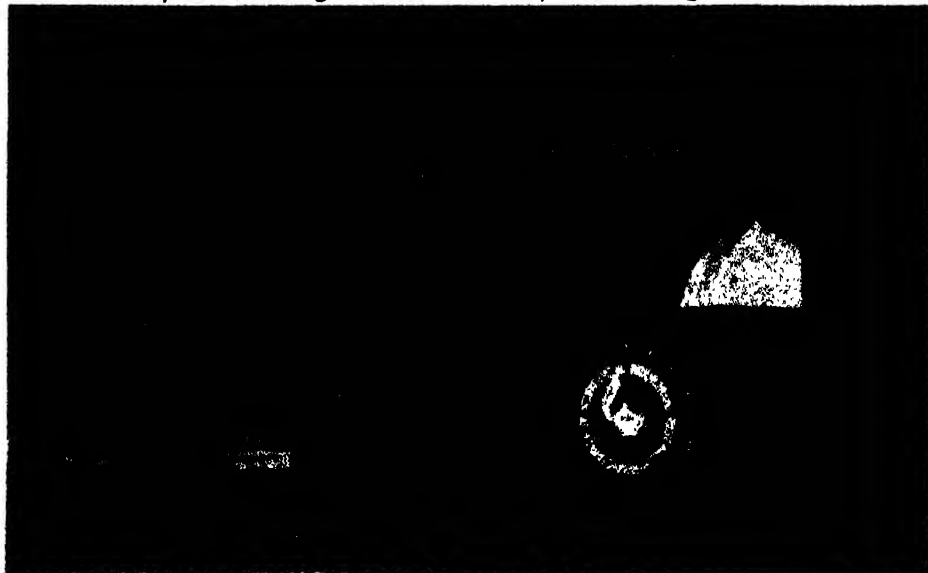
Dr D.K. Paul, Director, ISM, who was the Chief Guest at the valedictory function, said that dimensional stone mining by private agencies in different parts of the country was a major cause of agricultural land degradation. He advised that environmental planning and land reclamation programmes should be included at the mining planning itself to minimize ecological damage.

Dr T.N. Singh said that the recommendations of the seminar would make it possible to chalk out effective planning for eco-friendly reclamation of land degraded by mining.

Other distinguished guests who spoke on the occasion were: Shri S.P. Singh, Director (Technical), BCCL, and; Shri S.B. Das, Commissioner, CMPF, Dhanbad.

Some of the participants also expressed their views regarding the usefulness of the seminar and showed satisfaction over the way it was organized.

Shri M.L. Gupta, Scientist, CMRI, proposed a vote of thanks. □



Dr T.N. Singh delivering the welcome address during the seminar on Eco-friendly Rehabilitation of Degraded Land of Mining Areas

Chapman Conference on Stable Continental Region Earthquakes

IN several developing countries like India, the problems caused by Stable Continental Region (SCR) Earthquakes have become very serious because of high population density and non-engineered structures. To discuss the basic as well as applied significance of SCR earthquakes, a five-day international 'Chapman Conference on Stable Continental Region Earthquakes' was held at the National Geophysical Research Institute (NGRI), Hyderabad, from 25 January 1998, under the auspices of American Geophysical Union with active support from CSIR, Department of Science & Technology and Geological Survey of India. This conference is organized every year in the honour of Prof. Sydney Chapman, renowned Geophysicist, who devoted his career to solve some of the most challenging problems in solid earth geophysics.

Leading international and national scientists in the field of seis-

mology, tectonophysics, engineering and theoretical geophysics participated in this conference.

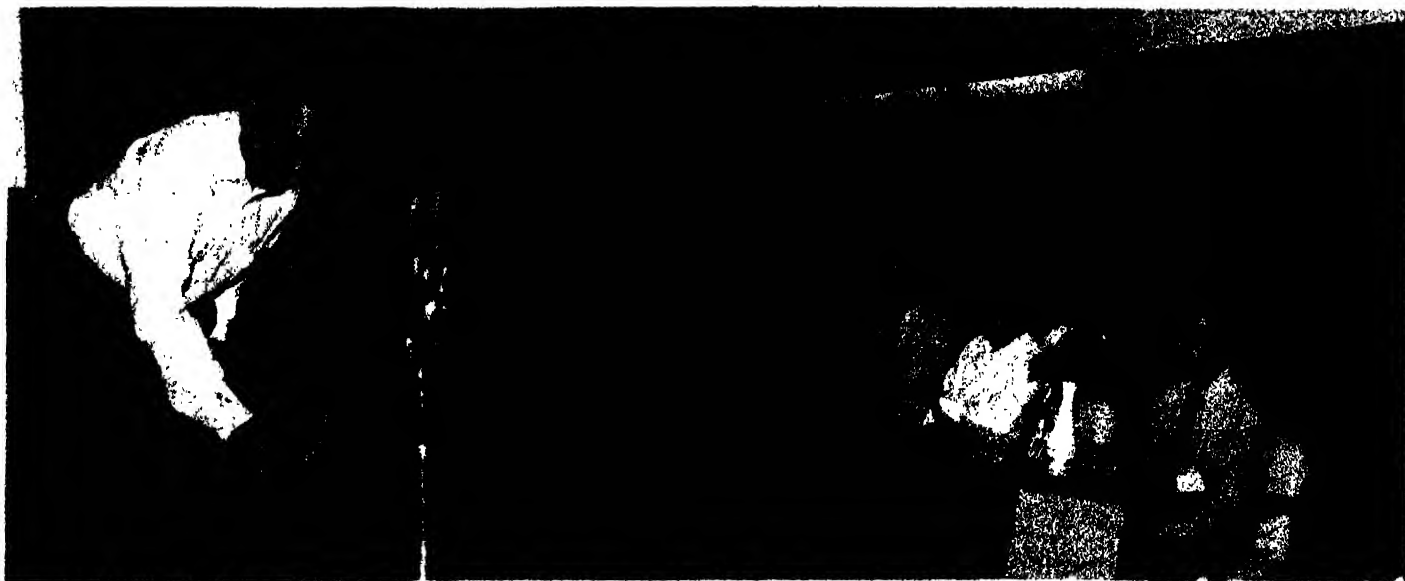
Welcoming the delegates during the inaugural session, Dr Harsh K. Gupta, Director, NGRI, and convener of the conference emphasized the need for undertaking the studies in SCR earthquake regions. He said that Latur earthquake area is one of the well investigated SCR earthquake regions. According to him, NGRI has set up more than 200 seismic stations in the country to monitor the seismic activity round the clock.

Dr P. Rama Rao, Chairman, Atomic Energy Regulatory Board, in his inaugural address underlined the need to predict the seismic activity well in advance and to come up with 'Comprehensive techniques'.

The inaugural address was followed by the invited lectures by Dr Arch. C. Johnston and Dr Harsh K. Gupta.

Dr Arch. C. Johnston from the Centre for Earthquake Research and Information, University of Memphis, dealt with the history of three New Madrid Earthquake sequences of 1811-12. The sequences contain perhaps the only example worldwide of coseismic surface rupture of the great thrust earthquake that crosses and disrupts a great continental drainage river, he said.

Delivering the special lecture on Koyna and Latur: Sites of unique SCR earthquakes in India, Dr Gupta said that there is a growing evidence that interplate regions were much more vulnerable to earthquakes than was hitherto thought. He said that investigations at Latur revealed a highly conductive low velocity fluid filled zone that exists below the focal regions of Latur earthquake sequence. The stress experienced in the region according to him is owing to uplift of Deccan plateau, triggered by erosion of upper crust, besides existence of low velocity zone that has enhanced stress concentration in uppermost part resulting in the mechanical failure, which caused the strong tremors in the Latur region.



Dr P. Rama Rao, Chairman, Atomic Energy Regulatory Board inaugurating the 'Chapman' Conference on Stable Continental Region Earthquakes' (left) and sitting on the dais (from left) are: Dr Harsh K. Gupta, Director NGRI; Dr Arch C. Johnston, University of Memphis; Dr P. Rama Rao and Dr P.R. Reddy, Scientist NGRI

Dr Gupta further said that the earthquakes in the vicinity of Koyna until 1992 were mostly confined to 20 km long seismic zone extending southward from Koyna. However, during 1993-94, a southward shift in the concentration of seismicity was noticed from Koyna to Warna reservoir. According to him, the shift might be related to filling of the Warna reservoir to over 60 m depth of water column in 1993.

Dr P. R. Reddy, Scientist, NGRI, proposed a vote of thanks.

In the technical sessions, a total number of 80 papers were presented in the oral and poster sessions dealing with: Seismicity and seismotectonics in different shield regions; Mechanics of SCR earthquakes; Stress and source parameters; Thermal and fluid pressure studies, and; Case history of SCR earthquakes.

Each session had a lead talk by an expert. Papers concerned with structure and mechanics, and some case studies were presented in the poster sessions.

Dr S. S. Rai (NGRI) suggested that the diverse lithospheric upliftment and erosion of metamorphic terrain is the primary cause for the earthquake activity in the south India granulite region.

Dr D. V. Subba Rao and Dr B. Ramalingeswar Rao (NGRI) were of the view that repeat observations of gravity, elevation and seismic station networks are necessary in the plateau regions of Latur, Koyna and Karnataka to substantiate the present uplift.

Drs V.G. Krishna, H.C. Tiwari and C.V.R.K. Rao (NGRI) said that the two dimensional velocity variation along Jabalpur-Thiruvananthapuram and Jabalpur-Koyna tran-

sects would help in determining the parameters of the stable continental earthquakes as well as planning future long-range seismic experiments in the Jabalpur region.

Dr Vinod K. Gaur, Indian Institute of Astrophysics, Bangalore, said that the GPS measurements over the past four years at Bangalore and at a dozen other locations in the southern Indian Peninsula and in Nepal have yielded significant data to quantify the translation and the broad-scale deformation of the Indian continent with sub-cms accuracy.

Dr S.K. Acharyya, GSI, Calcutta, advocated the reactivation potential of the ductile shear zones as well as those identified in Central India. The eastern margin of Sakoli belt (N-S) and other CITZ shear zones (ENE-WSW) need to be reassessed from the point of interplate seismicity, he said.

Dr T. Harinarayana (NGRI) reported that Jabalpur earthquake was associated with Narmada-Son-lineament south fault.

Dr Reena De, S.N. Chowdhury and P.R. Rao (GSI) said that the Junction of the Gondwana Basin Margin Fault (GBMF) and the Brahmini River possibly represent an asperity and produce the earthquakes owing to accumulation of strain generated by plate movements. Detection of such asperity zones in the shield area is useful for microzonation and hazard mitigation.

Dr B.S. Sukhija (NGRI) portrayed geological evidence of palaeoseismic events near Latur that took place around 2200 ± 200 YR BP.

Dr Harsh K. Gupta talked about borehole investigations at SCR

earthquake site with special reference to Latur earthquake.

Prof. Pradeep Talwani, University of South Carolina, concluded that with suitable geodetic surveys, it might be possible to detect localized pockets of stress accumulation before the next unexpected SCR earthquake occurs.

Drs C.P. Rajendran and K. Rajendran (CESS, Thiruvananthapuram) presented two cases of SCR earthquakes, i.e. Killari and Kachchh, one considered to be passive and the other active. They were of the view that even within the SCRs, the pattern of seismicity differs in its spatial and temporal characteristics.

According to Shri S. Roy and Dr R.U.M. Rao (NGRI), shallow focus and low heat flow in Latur area rule out a thermal cause for the Killari earthquakes.

Drs O.P. Pandey and P.K. Agrawal (NGRI) said that the unusual seismic activity in the Peninsular shield is owing to the underlying hot and upwarped asthenosphere which continuously creates localized stress owing to differential isothermal rise and large temperature differences on a regional scale beneath the highly fragmented Indian shield.

Dr R.B.K. Rastogi and Shri C.S.P. Sarma (NGRI) reviewed the incidence of reservoir induced seismicity in SCR of India with emphasis on Koyna. Dr R.K. Chadha (NGRI) spoke on the in situ pore pressure studies in the Koyna region, India.

During the panel discussion on 'Outstanding issues and future directions to study SCR earthquakes', experts from India and abroad participated in the discussions. □

WORKSHOPS

Workshop on Instrumentation and Control Systems for Energy Conservation

THE Central Scientific Instruments Organization (CSIO), Chandigarh, has taken up 'Energy Management Instrumentation' as one of its major projects during the 9th Five Year Plan. Workshops and training programs are being conducted under the project for the industrial technical personnel to promote energy conservation through the use of instruments and by adaptation of instrumental methods and practices.

To meet these objectives, CSIO Chennai Centre organized a three-day workshop on 'Instrumentation and Control Systems for Energy Conservation' during 11-13 March 1998.

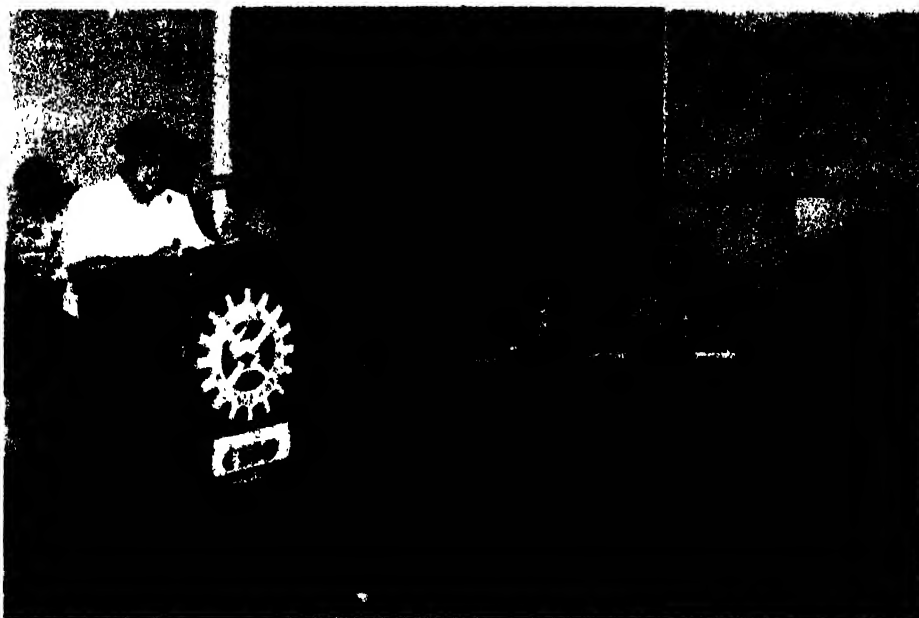
The workshop had a total of 20 participants, of which 13 were from industries, two from power generation units, three from R&D organizations, one each from consultancy organization and instrument manufacturers. The various topics covered in workshop were: measurement of temperature, humidity, flow & pressure; conventional and fuzzy logic controls; energy audit instruments; saving energy through the use of instruments; energy management systems; monitoring and targeting systems; industrial networking systems for energy studies, and; case studies in cement and paper industries.

The workshop was inaugurated by Dr G. Thyagarajan, Scientific Secretary, COSTED. Shri S. Mohan, Director, CSIO, presided over the inaugural function and the keynote address was delivered by Dr R. Natarajan, Director, IIT, Chennai. The relevance of strengthening calibration facilities for Energy Management Instruments was emphasized by the speakers.



Dr G. Thyagarajan delivering his inaugural address during the workshop on 'Instrumentation and Control Systems for Energy Conservation'. Sitting on the dais (from left) are: Dr R. Natarajan, Prof. S. Mohan and Shri R.K. Mohan Rao

The workshop provided a forum for the participants to enhance their knowledge by interacting and discussing the use of low-cost and sophisticated instruments for energy conservation. Participants were given hands-on-training on energy audit instruments and were shown the energy management system for petrochemical industry. □



Dr R. Natarajan delivering the keynote address during the workshop on 'Instrumentation and Control Systems for Energy Conservation'. Sitting on the dais (from left) are: Dr G. Thyagarajan, Prof. S. Mohan and Shri R.K. Mohan Rao

Winter School on Human Genetics: Concepts, Paradigms and Methods

A Winter School on Human Genetics: Concepts, Paradigms and Methods was held at the Indian Institute of Chemical Biology (IICB), Calcutta, in the recent past. The School was sponsored by the Department of Biotechnology (DBT), Government of India, and was jointly organized by the Indian Statistical Institute (ISI) and IICB. The organizing committee comprised Prof. Partha P. Majumder (ISI), Dr Susanta Roychoudhury (IICB), Dr Nitai P. Bhattacharyya (Saha Institute of Nuclear Physics), Dr Bidyut Roy (ISI) and Dr T.S. Rao (DBT).

The School was aimed at imparting training on the concepts, paradigms and principles underlying the methodology used in human genetics research. It was organized to provide the necessary background and enthusiasm to the students to pursue careers in human genetics, especially because human genetics is not included in the curricula of most Indian universities and medical colleges.

Sixty two participants from various Indian institutions participated in the Winter School.

In the inaugural session, the Directors of the host institutions, Prof. S.B. Rao (ISI) and Prof. J. Das (IICB), thanked DBT for sponsoring the Winter School. While Prof. J. Das emphasized the need for a clear understanding of principles and methods of molecular genetics in the pursuit of human genetics research, Prof. S.B. Rao emphasized the importance of statistical methodology in the designing of data collection and experiments and also in the analysis of collected data. Both Prof. Rao and Prof. Das felt that human genetics should be included in the university and medical college curricula in India. Shri Sujit Banerjee, Joint Secretary, DBT, and Dr T.S.

Rao stated that the DBT places high priority on human resource development, and, therefore, this Winter School was an important landmark. They also stated that it was very timely because the DBT has recently taken up two national initiatives on Human Genome Research and Human Genome Diversity.

Prof. Obaid Siddiqi, FRS, delivered the keynote address entitled 'Human Genetics in the Next Millennium'. Prof. Siddiqi highlighted the major achievements in human genome research in the past decades. Extrapolating these achievements and developments, he outlined his expectation in human genetics by the turn of the millennium. According to him, the human genome will be completely sequenced, comparisons of the human genome sequence with those of other organisms will yield considerable information about human gene function, research on animal models will gain ground primarily to understand functions of homologous genes in humans, DNA-chip will become enormously useful and

popular in medical and functional genetics, research on human genome diversity (both on contemporary DNA and ancient DNA) will yield major insights on human evolution, etc.

The broad topics covered in the Winter School were: History of human genetics and the human genome, Genome organization and evolution, Basic molecular and population genetics, Mutation detection, Positional cloning, Gene cloning, Formal genetics, Gene mapping, Genome diversity & affinity, Functional genomics and Genome databases. In addition, many special lectures were organized on Cancer-genetics, Genetics of cardiovascular disease, Immunogenetics, Triplet repeat diseases, Genetics of complex traits, Genetic counselling and Ethical issues in human genetics. Several demonstration sessions on PCR techniques, automated DNA sequencing and use of Internet were held during the School.

Faculty members of the School were drawn primarily from India including four from outside India.

The Winter School was a great success. All the participants stated that they benefitted enormously from the School and desired that such schools must be held regularly and more frequently. Most, however, felt that the course-work was too intense and the duration of the School was too long. Many suggested that the duration of future Schools be reduced from three weeks to two weeks. Many also suggested that separate Schools should be organized on human molecular genetics and statistical genetics, with hands-on training sessions. □



Prof. Obaid Siddiqi, FRS, delivering the keynote address during Winter School on 'Human Genetics : Concepts, Paradigms, and Methods'

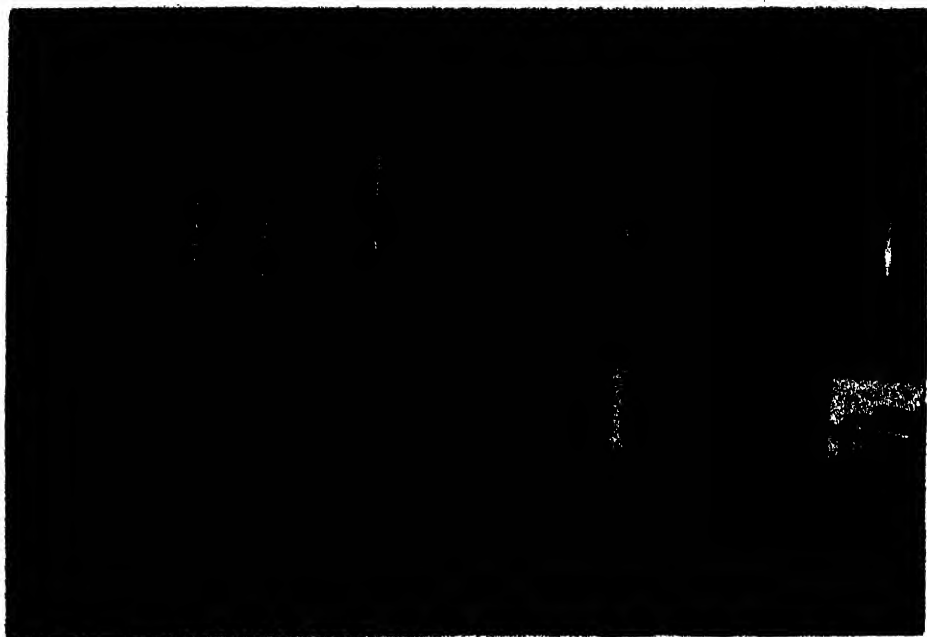
CSIO participates in WISITEX-98

THE Central Scientific Instruments Organisation (CSIO), Chandigarh, participated in the exhibition WISITEX-98 held at Pragati Maidan, New Delhi, during 5-9 February 1998.

The six themes for WISITEX-98 were: Telemations, Instrumentation and Control, Informatics and Software, Manufacturing Technologies—Systems and Aids, Media and Multimedia and Components & Materials. In addition, an International Business Summit with emphasis on Build India Technology 2000 + Investment was also organized during 6-8 February 1998 in which prominent speakers from India and abroad put forward their views.

CSIO exhibited the following instruments in the exhibition: Baby incubator; Hyperthermia system; Pulse oximeter; Micro drug infusion pump; Resuscitation bag for neonates; Nephelometer; Stack opacity meter; and Atomic force microscope.

The charts showing CSIO capabilities, technologies developed and marketed, technologies ready for commercialization and other strengths of CSIO were also displayed. Photographs of microelectronic instruments and their specifications were also depicted. The CSIO stall attracted a large number of visitors and many of them showed keen interest in CSIO's technologies. □



A view of the CSIO stall at WISITEX-98

NEW PUBLICATIONS

CSMCRI prepares Base Paper on Control of Brackishness

CSIR has identified the Central Salt & Marine Chemicals Research Institute (CSMCRI), Bhavnagar, as the coordinating laboratory for the Control of Brackishness in Drinking Water and asked CSMCRI to prepare a Base Paper on the above subject. Accordingly, a Base Paper on the Control of Brackishness in Drinking Water was prepared using the special fund provided by CSIR for this assignment.

The Base Paper prepared by Shri V.J. Shah, Dr N.V. Desai and Dr (Miss) S.V. Joshi is divided in seven sections which include drinking water quality and standards, status of desalination technology, international scenario, suitable desalination processes in Indian context, utilization of desalination technology in India and identification of future R&D in the area. □

HONOURS & AWARDS

Dr Ranajit K. Banerjee

DR Ranajit K. Banerjee (Bandyopadhyay), Deputy Director and Head, Department of Physiology, Indian Institute of Chemical Biology, (IICB), Calcutta, has been elected Fellow of the Indian National Science Academy (FNA).



Dr Banerjee, after postdoctoral research in USA, has been working in IICB for the last twenty years on structure-function aspects of plant and animal peroxidases, and biochemical mechanism of gastric hy-

Dr M. Raghavan appointed Director of CECRI

DR M. Raghavan, Acting Director, Central Electrochemical Research Institute (CECRI), Karaikudi, has assumed charge as Director of CECRI with effect from 29 April 1998. [For his biodata, See *CSIR News*, 48 (1998), 64].

Dr Raghavan has been actively associated with the Kundrakudi Model of Rural Development and other societal mission activities of CECRI. The institute has several human resource development programmes including the B. Tech. programme in Chemical and Electrochemical Engineering. Dr Raghavan has been associated



with all these programmes from the beginning. □

Dr Amit Ghosh takes over as Director of IMTECH

DR Amit Ghosh, Scientist F, Institute of Microbial Technology (IMTECH), Chandigarh, has assumed the charge as Director of the institute with effect from 7 April 1998 (afternoon) for a period of six years. □

Dr Somenath Banerjee

DR Somenath Banerjee of Indian Institute of Chemical Biology (IICB), Calcutta, has been nominated for the prestigious Homi Bhabha Memorial Oration Award in recognition of his outstanding contribution to the field of development of radiotracer for Nuclear Imaging. He delivered the lecture at the Society of Nuclear Medicine Annual Conference at Chandigarh.



Dr Banerjee did his Ph.D. in Synthetic Organic Chemistry (1968) and then moved to United States and subsequently joined IICB in 1981. His expertise is in the emerging biomedical discipline called Nuclear Imaging which deals with the imaging and evaluation of dynamic function of human organ system at cellular level. The key substrate of such imaging is ^{99m}Tc

peracidity and ulceration with emphasis on the role of reactive oxygen species on these pathogenesis. A notable contribution made by him relates to identification of active site residues involved in electron donor binding and electron transport as well as on the formation of enzyme catalytic intermediates (compound I/II) in horseradish peroxidase. He has further established that a highly active peroxidase present in the lacrimal gland and gastric mucosa plays an important role in protecting eye and gastric mucosa from oxidative damage by scavenging the endogenous H_2O_2 using SCN as an electron donor in presence of glutathione, glutathione reductase and NADPH. He has extensively studied the mechanism of drug-induced gastric hyperacidity by mercaptomethylimidazole, an antithyroid drug of thionamide group, which stimulates acid secretion by elevating the intracellular H_2O_2 . The plausible role of H_2O_2 to act like a

second messenger in parietal cell for acid secretion has been proposed.

Dr Banerjee has extensively studied the mechanism of stress-induced gastric ulceration. By direct measurement, he has established that hydroxyl radical generated during ischaemic stress is the major causative factor in stress ulcer which may now be regarded as ischaemic stomach disease.

Dr Banerjee and his colleagues also deserve the credit for identifying an active component in neem (*Azadirachta indica*) bark extract having potent antisecretory-antiulcer effect. This has tremendous importance for therapeutic application to control human sufferings of gastric hyperacidity and ulceration — one of the major global problems today. He is an elected Fellow of the Indian Academy of Sciences (FASc) and Fellow of the National Academy of Sciences (FNASc).

chelates (γ -emitting radiopharmaceutical) which must be carefully designed to acquire the desired physiological property.

Dr Banerjee, has developed, for the first time in India, two Tc chelates for renal and hepatobiliary function measurement. The potential of these compounds was at once realized by the industry and a joint collaboration was established between the Inventor (IICB, Calcutta), Industry (BRIT, Bombay) and Consumer (CMC, Vellore) to facilitate its further development. The appropriate authorities of radiopharmaceutical use, viz. the Radiopharmaceutical Committee and Nuclear Medicine Committee have already authorized the use of this drug on humans.

Earlier, another renal function agent was delivered at this laboratory (^{99m}Tc -cysteine) which because of its renal retention appeared somewhat unattractive to the clinicians. To correct these physiological problems the structure of the compound was established by X-ray crystallography, which is the first Tc compound characterized that way in India, and only in 1978, structure of the first Tc chelate was ever established.

This structure predicts that it can be used as a sulphydryl marker and may have the potential to identify the extent of cell damage anywhere in the human body. This may have enormous impact in estimating cellular damage in myocardial and cerebral infarction. These possibilities are being presently investigated.

Shri Asokan

SHRI Asokan P, Scientist, Regional Research Laboratory, Bhopal, has won M P Young Scientist Award in the 13th Session of M P Young Scientist Presentation in the faculty of Agriculture Sciences, which was held at Jiwaji University, Gwalior, during 20-22 March 1998. The title of the paper presented by him was 'Improvement



of the fertility of wasteland by the application of coal ash'. □

ANNOUNCEMENTS

International Symposium on Clean Coal Initiatives

THE Central Mining Research Institutes (CMRI), Dhanbad, is organizing an International Symposium on Clean Coal Initiatives during 22-24 January 1999.

The themes of the Symposium are: Eco-friendly Coal Mining Technology; Transportation of Coal; Preparation of Coal, and; Power Conversion from Coal. Preference is to be given to specific themes, Country/R&D papers.

The abstract of the paper should reach CMRI before 30 June 1998. The notification of acceptance of

abstracts will be communicated by 30 July 1998.

Last date of Registration is 18 December 1998.

For further details, please contact

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nic. in

Seminar-cum-Workshop on Materials and Characterization

A Workshop-cum-Seminar on Materials and Characterization is being organized in the Electrochemical Materials Science Division of the Central Electrochemical Research Institute (CECRI), Karaikudi, during 13-17 July 1998 in commemoration with the Golden Jubilee Year of the institute.

The Seminar is to be held on 13 July 1998 in which papers in the following areas are to be presented:

Semiconductor, ceramic and composite materials; Single crystal polycrystalline and amorphous materials; Electrocrystallization; Materials for solar energy conversion; Conducting polymer, phosphor and superconducting materials, and; Characterization techniques.

The workshop will be held during 14 - 17 July 1998. It is intended for young researchers and faculty members of colleges, universities and research institutes. The lectures

Dr R.A. Mashelkar Elected FRS

DR R. A. Mashelkar, Director General of the Council of Scientific & Industrial Research (CSIR) and Secretary, Department of Scientific & Industrial Research, has been elected a Fellow of the Royal Society of London (FRS).



The Royal Society, established in 1660, is the oldest and the most prestigious Scientific Society in the World. Since its inception, only 35 scientists of the Indian origin have been elected as FRS before. Dr Mashelkar has the distinction of being the third Indian engineer to get this honour. He is among the four scientists of Indian origin to have been conferred this honour this year in well over 330 year old history of the Royal Society.

FRS has been bestowed on Dr Mashelkar for "Improving Natural Knowledge" and pioneering contributions in polymer engineering, especially in modelling and simulation of polycondensation reactors, transport in swelling polymers, non-Newtonian fluid mechanics with special

reference to secondary flows and motion and deformation of particles.

Dr Murli Manohar Joshi, Minister of Science & Technology, while felicitating Dr Mashelkar on the occasion, said, "I am extremely happy at the election of Dr R.A. Mashelkar as a Fellow of Royal Society of London (FRS) for Improving Natural Knowledge. This Fellowship is well merited recognition of Dr Mashelkar's outstanding, pioneering contributions to polymer reaction engineering and gel science.

India has a rich heritage of science and technology. Dr Mashelkar is a true product of that heritage as he did all his brilliant research work in the country. The announcement of the election of Dr Mashelkar as FRS is thus an apt reaffirmation of the highest calibre of our scientists by the international community. Dr Mashelkar and his fellow scientists – Dr A.P.J. Kalam, Dr Chidambaram and many others are relentlessly working to revive the glorious era of Indian science and technology and the entire country is with them in their efforts.

While felicitating Dr Mashelkar on this well deserved recognition, I am confident that he will be able to take CSIR to new heights of innovation and creativity and fulfill the aspirations that the nation has from the science and technology." □

will be given by experienced scientists followed by demonstration of various experimental techniques employed in the characterization of materials. The Workshop participants will be provided with a computer package for evaluating photovoltaic and photoelectrochemical cell parameters.

Further details may be obtained from:

Dr (Smt.) Mary Juliana Chockalingam
Chairman
Seminar-cum-Workshop on Materials & Characterization
CECRI, Karaikudi-630 006. □

CMRI to Initiate Dialogue with Industry through Newsletter

THE CMRI Newsletter of the Central Mining Research Institute (CMRI), Dhanbad, is starting the new column 'Problem for the issue' with a view to initiating a dialogue with mining industry. This aims at better understanding of the problems of the industry and thereby providing need-based R&D support resulting in closer link between CMRI and its beneficiaries.

Under this programme, the mining personnel who are intimately associated with day-to-day production, safety, environmental problems and other mining activities, are requested to forward technical problems as and when they arise to the Director, CMRI, with reference to CMRI Newsletter. In each issue of the Newsletter, one selected problem will be dealt with in the new column.

Suggestions regarding R&D on existing mining problems as well as future technology needs of mining industry (both coal and noncoal) will be highly appreciated. One such selected suggestion will be published in another column 'Suggestion from the Industry'. □

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CSIR NEWS

Prime Minister presents Shanti Swarup Bhatnagar Prizes

THE Prime Minister, Shri Atal Behari Vajpayee, who is also the President of the Council of Scientific & Industrial Research (CSIR), presented the Shanti Swarup Bhatnagar Prizes for 1997 at a glittering function held in the NPL auditorium, New Delhi, on 25 May 1998. Attended by a large galaxy of distinguished scientists, the function was presided over by Prof. Murli Manohar Joshi, the Union Minister of Human Resource Development, Science & Technology, and Vice President, CSIR.

Extending heartiest congratulations to the awardees of Bhatnagar Prizes, the PM addressed the audience present during the function. The PM's speech on the occasion:

I would like to join my colleague, Dr Murli Manohar Joshi, in congratulating the four eminent Indian scientists who have been elected Fellow of the Royal Society. This international recognition to your seniors should inspire and spur you to strive to reach still higher levels of excellence. I would especially like to compliment Dr

Mashelkar, who is in our midst, for this honour. He is not only one of India's foremost scientists, but he has also proved to be an able science administrator. Under his leadership, CSIR has regained its dynamism and prestige, besides showing itself to be capable of standing up to the challenges of liberalization and globalization.

Friends, I must confess that both my work and my background are far removed from science. Yet, science and its achievements have always fascinated me. Besides fascination, science produces another impact on the lay mind. It creates national self-confidence. For example, our achievements in space science, computer science, agricultural sciences, chemical engineering, oceanography, and, of course, nuclear science fill our hearts with immense satisfaction.

Hence, I see a two-fold role for Indian science. On the one hand, it must continue to do what it is best at — improving the lives of the people and contributing to the develop-

ment of India as a strong and vibrant economic power. Simultaneously, Indian science must strive for excellence, which boosts our national self-confidence.

It is in order to draw the nation's attention to this two-fold benefit from, and responsibility of, Indian science that last week at Pokharan I gave the slogan: *Jai Jawan, Jai Kisan, Jai Vigyan*. Friends, I gave this slogan not just in recognition of the astounding scientific progress made by our nuclear scientists. Rather, Pokharan today symbolizes one of the greatest promises of science to transform India into a secure, self-reliant, and prosperous nation.

The slogan makes no claim to originality. I have only added two words to the electrifying slogan coined by our late and highly respected former Prime Minister, Shri Lal Bahadur Shastri, after the 1965 war. But I do believe that those two words, if understood well and acted upon well, have the potential to transform the face of India.



Prime Minister, Shri Atal Behari Vajpayee, addressing the scientists during Shanti Swarup Bhatnagar Prizes presentation function held at NPL, New Delhi

Friends, how shall we back this motto of *Jai Vigyan* with action? Permit me to present certain suggestions for the consideration of the scientific community, industry and policy makers in the Government.

ONE — We must make science and scientific temper an integral part of our national life and culture. Specifically, what is needed to universalize the scientific spirit is to launch what I would like to call an 'Innovation Movement'. The essence of science is innovation — that is, newness in thinking and action. Can we, as a nation, resolve to do whatever we are doing in our individual or collective spheres in better, more efficient, more economical, and more satisfying ways?

TWO — As far as institutionalized pursuit of science is concerned, what is coming in the way of progress is not so much money but bureaucracy of institutions that we have created. We need to make science, and the practitioners of science, central to all our planning and

operations. Administrators and government officials should be facilitators, and not masters of scientists. They should create conditions that encourage young scientists to do research and not push papers. Only in such an enabling environment can Indian science flourish. Any other way of managing science will only stifle it. This needs a radical change in the mindset of our science administrators.

Sustained motivation among scientists, especially young scientists, is absolutely cardinal to what we want to achieve. We would no doubt improve the working conditions and monetary rewards for our scientists. But, equally important, we should increase what I like to refer to as the "intellectual and psychic income", which all of you treasure the most.

THREE — It is sad that our system allows only an inferior status to engineers. The best engineering talent migrates from India to greener pastures either abroad or within the country. I am told that a large number of bright young people who get a degree in engineering subsequently branch off into non-engineering jobs which have a higher prestige and a bigger pay packet. As a result, areas such as manufacturing, original design and development of technology, and solving problems at the shop-floor have suffered. This needs to be reversed.

FOUR — We simply cannot neglect, as we have done so far, promotion of R&D in industry. I feel very worried when I see that investments in R&D by our industry, especially private industry, are minuscule compared to international standards. Naturally, there are hardly any products or brands coming out from Indian industry which

can stand global competition today.

Our industries must create knowledge networks with our universities, IITs and national laboratories in a '*Team India*' mode. For instance, right here we have the massive chain of 40 research laboratories of CSIR, in which the country has made heavy financial and human investments over the last fifty years. I urge the industry to forge powerful partnerships with these laboratories to gain entry into the global marketplace with winning technologies and then acquire a leadership position.

My vision is also to see many of these research laboratories as tomorrow's self-financing '*Knowledge Corporations*' with both financial and operational autonomy, and capable of becoming world-leaders in their own right.

FIVE — We need to accord greater recognition to highly talented scientists not only within the scientific community, but also in the large national community. Today, the entire nation feels proud of the Pokharan team led by Dr Abdul Kalam, Dr Chidambaram, Dr Kakodkar and Dr Santhanam.

The Indian tradition has always held *gyanis* — that is, persons of learning — in a higher esteem than the rulers. It is, therefore, not surprising that Dr Abdul Kalam should be a Bharat Ratna, whereas I am only a Padma Vibhushan! I want this kind of recognition for the other achievements of Indian scientists as well. I want to bring Indian science and Indian scientists to the forefront of our nation's attention. In this, the media can play a vital supportive role by giving prime-time and prime-space focus on our scientific talent.

SIX — There is a need to make scientific research in our country more and more application-based. The questions that ought to seize the minds of both scientists and the people in government and industry are many.

For example, our agriculture scientists deserve a pat on the back for helping India attain food self-sufficiency. Their efforts in boosting wheat production have greatly succeeded. Now, how can we extend that success to other crops, especially in those areas where our *kisans* depend on dryland farming? How can we expand and improve our base of agro-based rural industries, which not only add value but also generate local employment? How can medical research bring down the cost of health-care? How can we launch a massive nationwide drive for energy-saving and material-saving? How can we produce more with less?

Some of the problems in this area are truly critical and brook no delay. Water conservation is one of them. Our scientists and our society

must together find early answers to this problem.

SEVEN — We need to make the use of Information Technology a national campaign. My Government has set up a Task Force that will prepare the draft of a comprehensive National Informatics Policy. It will also recommend an appropriate institutional mechanism to implement it as a national mission.

This is an area where India can attain global dominance in a short time. Besides, thousands of new applications are possible in this area which will generate high-quality jobs and improve the quality of life for the masses. I would, therefore, urge the scientific community to take up Information Technology-based research as a challenge. You should help create products and services that will serve as a productivity-multiplier within India and also command high value in the world market.

EIGHT — Indian science must face globalization with courage and

Eleventh May announced as Technology Day by the Prime Minister

THE month of May 1998, has indeed been a glorious month for Science & Technology in the history of India.

Speaking during the Shanti Swarup Bhatnagar Prize Distribution Function, organized by the Human Resource Development Group, CSIR, the Prime Minister, promptly accepted Prof. Joshi's suggestion, and declared 11 May as "Technology Day" in future. □

confidence and make it work to our national advantage. As I had remarked in my first television address to the nation, India has a right to be angry at seeing foreigners filing patents on *haldi*, *neem* and *basmati* rice. We will fight these patents and safeguard India's national interests. Indeed, CSIR has shown the way by winning the battle over the *haldi* patent.

It is far more important, however, to know that we should develop more and more patents ourselves and also quickly move in the direction of their commercialization. There is a need to bridge the time gap between discovery and the marketplace. Let me emphasize that, increasingly, Intellectual Property Rights will become key strategic tools in the emerging era of knowledge-based competition. I am happy, therefore to learn that CSIR has filed as many as 90 patents in USA and Europe in last year alone, protecting our exclusive technologies and our traditional knowledge. This is an example that other re-



The prize-winners with Shri Atal Behari Vajpayee, Dr Murli Manohar Joshi and Dr R.A. Mashelkar

search institutions could do well to emulate.

NINE — In order to lift the prestige of Indian science, both nationally and internationally, I would strongly urge you to focus on some select areas of research, including basic research, where you can show global excellence. Let India become a leader, and not merely a follower, in science at least in some areas. Let us open up exciting new frontiers of knowledge ourselves, with the goal that some of these will be worthy of Nobel Prizes in the first decade of the next century.

Last but not the least, we must pay attention to our children. We must overhaul the system of science education in the country to base it on knowledge and creativity, and not on memorizing and examinations. I am convinced that our young generation is far brighter than my generation. They also have access to powerful learning tools such as computers, the Internet and television. It is our responsibility to create an educational system which will allow the unlocking of the enormous storehouse of intellectual energy in our young generation.

Friends, these suggestions are neither exhaustive nor conclusive. I urge the entire Indian scientific community — that is, old and young scientists, science teachers and students, science administrators, science popularizers, the media, industry and policy-making bodies in the Central and State governments — to deliberate on how to harness the full potential of science for nation-building.

After a few months of nationwide discussions, we should come up with an energizing charter of action. As far as my Government is concerned, I have no doubt about

our fullest and most enthusiastic support to its implementation. I say this because the Minister of Science and Technology, Dr Murli Manohar Joshi, is himself not only a scientist and a teacher, but also brings deep personal commitment to this cause which is so dear to his heart.

I once again congratulate the winners of the Shanti Swarup Bhatnagar awards.

Earlier, Dr Murli Manohar Joshi, the Minister for Science and Technology, addressed the audience. The following is the text of the Minister's speech.

Respected and beloved Prime Minister Shri Vajpaijee, Dr Mashelkar, FRS, Director General CSIR, Dr Raychaudhuri and doyen of Indian science, the distinguished scientists who are sitting here and winners of the Award and fellow scientists. As Dr Mashelkar has said, I have been, once upon a time, a Junior Research Fellow in the CSIR.

At the outset, I would like to thank the Hon'ble Prime Minister for agreeing to grace this function. His gracious gesture re-establishes the earlier traditions wherein the Prime Minister publicly affirms the government support and commitment to science and technology by honouring our worthy scientists and technologists. Our Government not only reaffirms the faith that the founding fathers of the nation have reposed in Science and Technology but we would like to accord the position of prestige and honour to our scientists and technologists.

The development of the past few weeks have once again brought India at the central stage of global politics. The 11th of May 1998 was a very special day for Indian Technology. We had 3 great events on

that day. The first event of the day at 12:50 p.m. was of the successful test flight for final certification of Hansa-3, the first of composite indigenous aircraft built by CSIR. The second was followed a few minutes later by the successful test firing of the Trishul missile. The third and the most momentous was the three successful nuclear tests. I would just like to suggest the Hon'ble Prime Minister to consider that 11th May be declared as Technology Day just as 28th February is celebrated as Science Day in recognition of the discovery of Raman Effect.

A further recognition of India's standing in the scientific world came on 14th May with the election of four Indian scientists as fellows of the prestigious and oldest of the Science Society, the Royal Society London. I am told, for the 330 years history of the Royal Society, there have been only 35 Indians elected as fellows. I believe that election of four Indian scientists this year is a tribute, and, fitting recognition of Indian science and I am personally very happy and proud because Dr Mashelkar is directly related to the Ministry of which I am incharge and Prof. Ashok Sen belongs to Mehta Institute, Allahabad, which is affiliated to the University of Allahabad for its research work, where I have been a Professor for all my life and also that he is the second scientist from Allahabad to get the honour. The first was Prof. Meghnath Saha and I have the unique honour of heading the Laboratory founded by Prof. Meghnath Saha for a very very long spell. So, this is the occasion of great joy and pride for me personally.

Two of the Indian scientists, Dr H.K.D.H. Bhadeshia (Cambridge University) and Dr Srinivasa Varadhan (New York University) are pres-

ently working abroad. The other two, Prof. Ashok Sen at Mehta Research Institute and Dr Mashelkar, DG, CSIR, are working in India. Our heartfelt congratulations to all four of them for doing India great proud.

The vision to build the new India of our dreams can not merely be a derivative of the past. It has to be of course based on the reality of the present. But it has to have a boldness, ambition and hope which is commensurate with the aspirations of this great nation in recognition of the heightened aspirations that the people have from science and technology. I had instructed CSIR to assemble together the Directors of all the Laboratories so that we could brain storm about how CSIR could serve the nation still better. I just took two days meeting of the CSIR Directors on 11th and 12th May 1998 at Bangalore wherein we considered 10 strategy papers dealing with: (i). Science & Technology for commonman; (ii). Competitiveness in Indian industry; (iii). Value addition to indigenous resources, and; (iv). Attaining global leadership in Science. We are now giving finishing touches to these strategy papers which I would then like to submit to the Hon'ble Prime Minister for his consideration and decision. I have set therein very specific time and task targets for CSIR and I am confident that CSIR will be able to meet these.

Talking of our achievements, I would like to applaud the young scientists and technologists assembled here today for their magnificent work that secured them the prestigious Bhatnagar Prize. The award brings with it the recognition, honour and prestige as Bhatnagar Awards have come to enjoy the highest reputation nationally and internationally. At the same time, I feel

that award also reposes a heavy responsibility on the awardees. You are now a role model for your budding colleagues and have to set for them an example to pursue excellence in science and technology, high level of ethics and also charting out newer paths that are truly endogenous. I believe that for too long now Indian Science and Technology has sought the trodden path set for us by others.

In the past, Indian philosophers and scientists had given the world the original and new path in diverse scientific areas such as medicine, metallurgy, mathematics, chemistry, physics, biology and a lot. The use of mercury and other metals as *Bhasums* are therapeutics is still considered to be a new area in Western Medicine. My appeal to you, the Bhatnagar Awardees, is to break out from the trodden and established path and pioneer new thinking and avenues. It is only then that the world will once again look up to India as a provider for new science and technology. The quality of the Indian basic research in the

new millennium will need to undergo a sea change. We should aim for world leadership in science again. The new Indian science should be one that leads and not follows, I repeat, that leads and not follows. It will need to be based on a daring and creativity.

Promoting curiosity based research with new sense of adventure would be the Indian endeavour. In the next millennium, Indian science and technology can play a crucial role in catalyzing and accelerating the economic and social development. This becomes clear, when we recognize that the comparative advantage that the globally integrated knowledge based world economy today is shifting to those with brain power to absorb, assimilate and adopt spectacular developments in science and harness them for national growth. Whereas investments in the physical infrastructure on energy, transport and communications are crucial, it is the intellectual infrastructure derived through powerful science and technology that will give India a comparative advantage.



Dr Murli Manohar Joshi in conversation with Dr R.A. Mashelkar during the SS Bhatnagar Prizes presentation function

Judicious investments will have to be made in building infrastructure by investing more than hitherto in higher education and science and technology.

Partnership with nature and also with our past, our traditional knowledge base and community knowledge needs to be harnessed and uniquely enhanced by using cutting edge science. Our vast biodiversity needs to be conserved and our long coastal zones and unexploited oceans provide us vast opportunities be they for drugs, alternative sources of energy and gas hydrates or minerals. We again need to recreate the spirit of adventure by exploring nature and our abundant knowledge resources using the tools of new science. One of the hallmarks of Indian civilization from the very ancient times was to develop harmony with life and nature and to establish the infinite potential of human development. As a long term vision, India should lead the world in establishing and demonstrating the harmony between science and its spirituality in the development and application of science with ethics as the backbone. Scientific temper and true joy of science will be unfolded when the harmony between science and mankind's highest quest is achieved and I am sure Mr Hon'ble Prime Minister, Sir, under your able leadership we will achieve this.

The function began with the welcome speech by Dr R.A. Mashelkar, DG, CSIR, which is as follows.

Our beloved Prime Minister Hon'ble Shri Atal Bihari Vajpayeeji, respected Minister for Human Resource Development and Science and Technology, Hon'ble Murli Manohar Joshi, Dr Raychaudhari, many men of eminence in Indian

Science that I see in the audience, Prof. Menon, Dr Ramalingaswami, Dr Srinivasan, Dr Varadarajan, proud award winners and their families, distinguished invitees, members of my CSIR family, Ladies and Gentlemen. Let me first of all extend a very warm welcome to all of you on this very special, very privileged morning. It gives me immense pleasure to welcome our revered Hon'ble Prime Minister amongst us not only on behalf of all of us who are present in the auditorium but also on behalf of the entire scientific community of India.

CSIR today symbolizes a big commitment to the cause of furtherance of excellence of Indian Science. I am also delighted to welcome our Hon'ble Minister, Prof. Murli Manohar Joshi, who in a short duration of just over two months has really galvanized, challenged and charged the scientific community of India. We in CSIR have felt the immense impact of his commitment and vision.

Today is a special day for CSIR. As you know, CSIR has been involved in the process of nation building for over 50 years now. CSIR simply advances knowledge and uses it for the good of the Indian people. We strive very hard to make a strong economic sense of science, a social sense of science, but we also work very hard for Human Resource Development, that is building the scientists of tomorrow. Supporting science in universities and other institutions is one such endeavour, like for instance for our Research Fellowship Program. Sir, it is with great pride that we recall that even our Hon'ble Minister, Prof. Murli Manohar Joshi, was once a Junior Research Fellow of CSIR. Recognizing and rewarding science is one of our key endeavours, and Bhatnagar Prizes which we instituted in the

name of Dr S.S. Bhatnagar, a great scientist and a great visionary, is one of the key events. This prize was instituted in 1957 with a view to recognize excellence among young scientists below the age of 45 years and so far a total of 313 Scientists have won this prize. Nine more will join this exclusive club of Bhatnagar laureates. I want to congratulate all these new Bhatnagar Laureates. As a former Bhatnagar Awardee, I do remember the sense of jubilation and pride. One gets so many honours and awards in life when one is lucky, but Bhatnagar Prize is something very special. I know what you must have gone through. A very warm congratulations to all of you and also to your families. You are reaping the reward of your dedication to the Goddess Saraswati. As you know, she is a very demanding Goddess. I know what role your families must have played in allowing you to do this Saraswati puja relentlessly. I am sure you will continue to do that. I want to congratulate you all once again.

We are holding this award ceremony in the month of May 1998 and I think in the history of India, May 1998 is going to be remembered forever. Eleventh May 1998 was indeed a magical day. A momentous day in the life of every Indian. Pokharan-II was not just a series of successful nuclear tests demonstrating the redoubtable strength of Indian science and engineering, it was more than that. Pokharan-II was a symbol of this nation's determination to assert its preeminent position in the Comity of Nations. Sir, you made it possible. The entire Indian Scientific Community has been galvanized and charged like never before. The feeling of self-pride, the great sense of enthusiasm and feeling of rededication to the cause of

building this nation of your dream is there for all to see and feel.

May I share with you, Sir, a every personal moment, a personal experience on 11th May. Our Hon'ble Minister, Prof. Joshi, being given a new charge, has given a new direction, a new vision to CSIR. Under his direction, we had organized a two days' very serious brain storming meeting of CSIR Directors at Bangalore on 11th and 12th May. It was a unique event where for the first time in CSIR's history, the Vice President of CSIR has spent two full days, 48 hours, discussing and reviewing our programmes. It was in the midst of this brain storming on 11th May, that the news of Pokharan-II came. The sense of joy and jubilation that was created in that Conference Room was absolutely electric. That feeling of self pride and determination has pervaded the entire Scientific Community today. Sir, your subsequent pronouncement of *Jai Jawan, Jai Kisan, Jai Vigyan* has again electrified the entire Scientific Community. We as scientists, interpret *Jai Vigyan* as your clarion call to the Indian Scientific Community to use *Vigyan* as a propelling force to catapult this great nation to even greater heights. As we see it, the process of resurgence has already started. Indian Science will have to be at the centre stage with this process of resurgence of India continues and it requires a renaissance of Indian Science. As we move into the next millennium, the charge that you have given us by your pronouncement of *Jai Jawan, Jai Kisan, Jai Vigyan* will propel us to heights that are unimaginable. On behalf of the entire Scientific Community, I wish to assure you, Sir, that we will rededicate ourselves with heart and soul in building this great nation of your dream.

For the year 1997, nine proud awardees were presented with the award in Five disciplines of Science. Dr Mashelkar read out the citations of the awardees in each discipline. The details of the citations are given below.

CITATIONS **Shanti Swarup Bhatnagar** **Prizes: 1997**

Physical Sciences — Jointly awarded to Dr Bikas Kanta Chakrabarti of the Saha Institute of Nuclear Physics, Calcutta and Dr Amitava Raychaudhuri of the University of Calcutta, Calcutta.

Dr Chakrabarti has made outstanding contributions to the current understanding of the physics of the dielectric breakdown and fracture phenomena in the disordered solids, quantum Ising glass models, and dynamic phase transitions in the Ising systems.

Dr Raychaudhuri has made outstanding contributions to the physics, beyond and alternative to the standard model of particle physics, including the processes involving supersymmetry and electroweak interactions with the right handed currents.

Chemical Sciences — Jointly awarded to Dr Kankan Bhattacharyya of the Indian Association for the Cultivation of Science, Calcutta and Dr Adusumilli Srikrishna of the Indian Institute of Science, Bangalore.

Dr Bhattacharyya has made outstanding contributions to unravel the ultrafast processes in complex biological and supramolecular assemblies using laser spectroscopy.

Dr Srikrishna has contributed significantly to the area of organic synthesis. His contributions in the area of radical cyclisation and annu-

lation based strategies for the synthesis of natural products are noteworthy.

Biological Sciences — Jointly awarded to Dr Jayaraman Gowrishankar of the Centre for Cellular and Molecular Biology, Hyderabad and Dr Kanury Venkata Subba Rao of the International Centre for Genetic Engineering and Biotechnology, New Delhi.

Dr Gowrishankar has made significant contributions in elucidating the molecular genetics of osmoregulation in *Escherichia coli* with important biotechnological applications. This work has led to the development of a salt inducible expression vector. Recently, he has developed an imaginative bacterial system to demonstrate that mutations can arise in stationary state bacteria.

Dr Rao has made outstanding contributions in the design of synthetic peptide vaccines based on the regeneration of conformational epitopes and self association of such peptides to give high immunogenicity in humans. He has also contributed significantly to the understanding of the antigen-specific B cell selection and amplification. He has also been involved in the development of HIV diagnostics.

Engineering Sciences — Awarded to Dr Devang V. Khakhar of the Indian Institute of Technology, Mumbai, for his pioneering work on the polymerization of rod-like molecules and shear flow induced enhancement of the rates of polymerization.

Medical Sciences — Jointly awarded to Dr Satish Kumar Gupta of the National Institute of Immunology, New Delhi and Dr Vijay Kumar of the International Centre for Ge-

netic Engineering & Biotechnology, New Delhi.

Dr Gupta has contributed to the development of indigenous diagnostic reagents of medical importance and done outstanding work on the possible use of zona pellucida proteins in designing immuno-contraceptive measures.

Dr Kumar has contributed to basic understanding of the transactiva-

tor domain of the 'X' protein of the hepatitis B virus. He has been instrumental in technically assembling the multiepitope protein gene for hepatitis B virus. These have led to significant understanding of the basic immunology and biology of hepatitis B virus.

No awards were given in Earth Atmosphere Ocean & Planetary Sciences, and Mathematical Sciences. □

IICT's New Initiatives to attract Japanese Contract Research

A four member CSIR delegation visited Tokyo for holding the first ever business meeting of the CSIR laboratories represented by IICT, NCL, CDRI and ITRC on 4 November 1997 for exploring the Japanese technological market. The meeting, arranged at the auditorium of the Indian Embassy, was formally inaugurated by Shri Siddarth Singh, the Ambassador of India in Japan. Dr V.T. Chitnis, Counsellor (S&T), Indian Embassy, Tokyo, and Dr A.K. Guha, Deputy

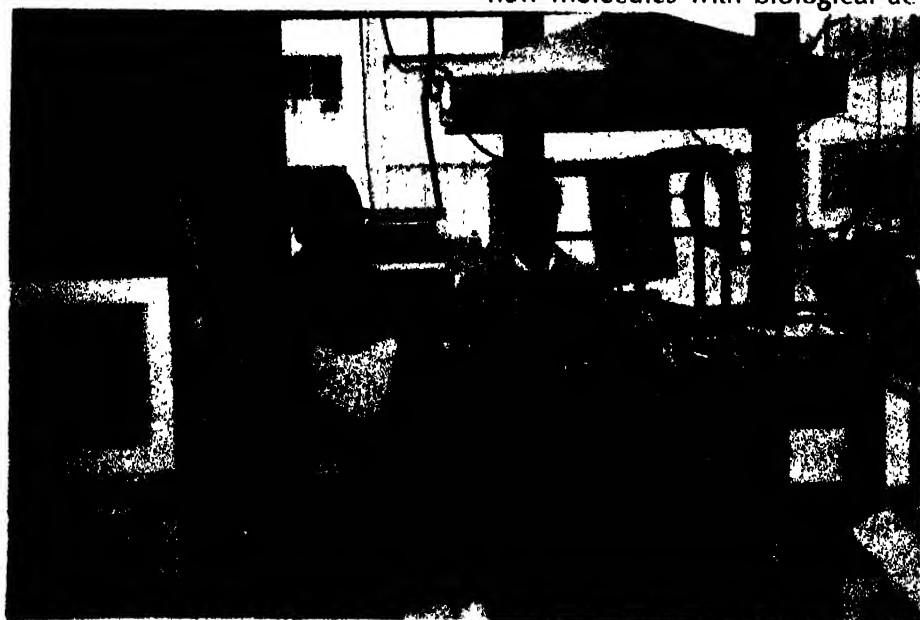
Adviser (CSIR) attended the meeting.

Japan, the global economic power, is constantly in search of original and innovative new products and technologies laying an enhanced emphasis on outsourcing its technological needs, viz. novel basic chemicals through innovative technologies, advanced materials/polymers for optoelectronics and information storage, effective environment preservation systems, new molecules with biological ac-

tivities for therapeutic applications and bioprocess based technologies.

Dr Ahmed Kamal, Scientist (Biotransformation), represented the Indian Institute of Chemical Technology (IICT), Hyderabad, for making a scientific-cum-business presentation on IICT's new molecules design/development capabilities. Dr Kamal later visited Yamanouchi Pharmaceutical Company Ltd, Nippon Kayku Ltd, Nissui Pharmaceutical Company Ltd, Nippon Shokubai Company Ltd and Agro Kanesho Corporation Ltd for direct scientific interactions. This endeavour enabled IICT to enter into its first ever research contract with a Japanese company, viz. M/s Yamanouchi Pharmaceutical Company Ltd for synthesis of novel drug molecules. Negotiations are now in progress with three more companies.

Encouraged by the response received from the Japanese drugs/pharmaceutical sector of the first business meeting, the IICT organized its second business meeting in Tokyo on 27 March 1998 at the Indian Embassy to cover envirocatalysis, performance and speciality chemicals and knowledge-based services. Dr K.V. Raghavan, Director, IICT represented IICT. He held discussions with Shri Siddarth Singh regarding the future prospects of Indo-Japanese collaboration and with Dr Chitnis regarding the organizational and technical activities of the Business Meeting. Dr Raghavan visited M/s Yamanouchi Pharmaceuticals, M/s Nippon Shokubai and Summit Pharmaceuticals for more detailed discussions. The companies showed interest in organic intermediates, new drug molecules, high performance catalysts, specialized performance chemicals and materials/polymers. □



Dr K.V. Raghavan (left) on a visit to Environmental Chemistry Laboratory of NIHLR, Tokyo

Poly (Cardanyl Acrylate): A Transparent Resin for Surface Coating Applications

THE Regional Research Laboratory (RRL), Thiruvananthapuram, has now developed technology at the laboratory scale for the preparation of transparent/clear resin from CNSL/cardanol as part of a sponsored project from M/s Vijayalexmi Cashew Company (VLC), Kollam. The utilization of CNSL is restricted due to its colour as only brown or dark brown products can be made from it impeding its competitiveness with synthetic resins. It was therefore decided that the development of a transparent/clear resin from CNSL, if achieved, would totally solve many of the problems in the utilization of CNSL.

The RRL has been successful in converting cardanol into a free radical polymerizable monomer such as cardanyl acrylate (CA)/methacrylate (CMA) by acrylation/methacrylation. Bulk or solution polymerization with appropriate free radical initiators gave poly (cardanyl acrylate) (PCA)/methacrylate (PCMA). Evaporation of the solvent gave transparent films. Suspension polymerization gave uniform sized transparent beads. Aqueous emul-

sion of PCA/PMCA could also be made.

The approximate cost of production of PCA comes to ~ Rs 150.00 per kg. This process has the potential to utilize CNSL for the preparation of clear/transparent coatings and paints of all colours. It is expected to bring down the cost by process optimization for large scale production and by using CNSL instead of cardanol. The technology for the production of PCA has been transferred to VLC.

The possible advantages offered by the utilization of PCA are:

- Fully transparent and water clear resin (PCA) obtained from cardanol by acrylation and polymerization is suitable as vehicle for pigment of any colour for paint formulations.
- PCA being a thermoset acrylic resin, has the potential for a number of applications including automobile body surface coatings.
- PCA can also be prepared as emulsion acrylics.
- PCA and PCMA being curable under controlled conditions to give thermoset films, have potential for use in electronic applications. This aspect needs further investigations for evaluating the usefulness of PCA and PCMA.
- PCA and PCMA can be converted into polymer supports and hence can find applications in polymer support materials.
- Copolymers of PCA and PCMA with acrylic monomers are expected to exhibit better properties

and hence are worthwhile for further investigation.

- PCA and PCMA can also find applications as matrix resin for composites.
- PCA and PCMA can also be processed as adhesives. □

Indigenization of Strategic Materials & Processes

THE Indian Space Research Organization (ISRO) has embarked on the indigenization of materials and processes needed for their development, keeping in view the strategic importance of these materials for space applications and the possible embargo on their import. The Regional Research Laboratory (RRL), Thiruvananthapuram, has been carrying out investigations on some contract projects sponsored by the Liquid Propulsion Systems Centre (LPSC), Valiamala, Thiruvananthapuram. The laboratory has completed studies on three such projects for ISRO so far. In addition, there are two ongoing projects also funded by ISRO.

The objective of one of the ISRO funded and completed projects was to develop and standardize heat treatment schedule for both imported and indigenous Al-Zn-Mg alloy. These investigations have been found to be useful for: (i) selection of annealing temperatures and formability studies of the water tank terminal shells, (ii) conducting studies on the effect of postweld heat treatment on parent metals and weldments, and (iii) selection of filler wire for water tank and propellant tank. The laboratory has received a commendation letter from LPSC informing it that the test data



SEM photograph of polymer beads from PCA

provided by the laboratory have been of immense help to assess the integrity of the hardware for successful proof pressure testing of PS₂, propellant tank and water tank.

The Second completed project related to developing thin-walled aluminium alloy battery box castings conforming to ASTM B grade, enabling the laboratory to build necessary expertise to develop premium quality aluminium alloy casting in the country.

The third project related to developing indigenously the aluminium alloy and its cast components for Vikas Engine of PSLV possessing strength properties and quality comparable to French specifications and supplying 33 cast components ranging from 2 to 20 kg with intricate shapes. The successfully completed investigations included handing over the Project Completion Report containing process details, results obtained and quality evaluation report containing code of practice and acceptance criteria of sand castings for aerospace applications.

A number of radiographically tested cast components were also handed over to ISRO. On this occasion, Dr G. Vijay Nair, Director, RRL, Thiruvananthapuram, in his welcome address, briefly mentioned the activities of the RRL and the work carried out for ISRO by the laboratory. He elaborated the close interaction between the RRL and ISRO through sponsored and collaborative projects from VSSC/LPSC/SAC. He dealt with the possibility of taking up more projects for space applications in view of the capabilities built up in the laboratory particularly in the area of alloys and composites. According to him, this type of collaboration between the two organizations will go a long way in developing and utiliz-

ing expertise to meet the demands of materials and processes for strategic space applications. Underlining the need for financial support from LPSC/ISRO, he emphasized the need to augment the foundry facilities at the RRL which are essential to take up further development and supply of Al alloys and other materials required for PSLV/GSLV projects.

Shri B.R. Ghosh, Engineer, LPSC, ISRO, Thiruvananthapuram, briefly dealt with the background of the project on indigenization of castings for PSLV and intricacies involved in the development of these castings. He highlighted the role played by the Quality Division of VSSC, ISRO, for NDT evaluation of castings produced by the RRL.

Dr K.G. Satyanarayana, Project Leader, presented details of the project. He underlined the tasks involved regarding the development of an Al-alloy equivalent to the French Specification AS7G, quality control aspects during melting and casting, mould preparation, property evaluation, NDE and final casting. He dealt with the challenges faced in developing processes for obtaining the desired quality of Al-alloy castings conforming to microstructure, mechanical properties comparable to imported AS7G alloy castings from France, characterization of the sand castings and heat treatment procedures. These had to be attained along with 100% radiographic testing, and last but not the least, pressure tightness to withstand a pressure of 40 bar for 15 min. In fact, this development has made it possible to achieve higher ultimate tensile strength and percentage elongation values both in



Cast components developed at
RRL-Thiruvananthapuram

sand and permanent mould castings using indigenous Al-alloys containing iron content of 0.2 wt % compared to French specifications with similar alloy but having lower iron content. This is achieved through proper control of melt composition, degassing treatments and other melt treatments, and appropriate heat treatment schedules. The indigenous Al sand castings showed microstructure and strength properties comparable to imported Al castings. The castings also withstood pressure tightness of 40 bar for 20 min. compared to specified 40 bars for 15 min. for imported ones. He also underlined the significance of bringing out Code of Practice and Acceptance Criteria for Al-alloy Sand Castings as imported castings have to be used in the absence of any standards. He also presented a proposal to the Director, LPSC, for augmenting the foundry facilities for the development and supply of special Al-alloy castings.

Dr Vijay Nair, presented three copies of the Project Completion Report and some Al-alloy castings produced by the laboratory to Padmashri G. Madhavan Nair, Director, LPSC, Thiruvananthapuram.

Congratulating the staff of the RRL, who carried out the work for LPSC, Dr Madhavan Nair talked



about the necessity to continue the studies on indigenization for future casting requirements of LPSC to overcome the possible threat of embargo on these products by western countries and producing the castings which may be comparable in cost to the imported castings. He also suggested the formation of a committee consisting of scientists from the RRL, LPSC and VSSC to chalk out clear cut proposals with time-targeted outputs keeping in view the existing facilities at the RRL/VSSC/LPSC and the needed augmentation in funding for the RRL and assured necessary inputs to the RRL for taking up such mutually beneficial programmes.

Dr B.C. Pai, Head, MPD of the laboratory, proposed the vote of thanks. □

Dr G. Vijay Nair, Director, RRL-Thiruvananthapuram (left) presenting the Project Completion Report to Padmashri (Dr) G. Madhavan Nair, Director, LPSC, Thiruvananthapuram

WORKSHOPS

INDO-US-Workshop on Lead and Other Heavy Metals: Sensitive Population at High Risk

THE Industrial Toxicology Research Centre (ITRC), Lucknow, organized an Indo-US Workshop on Lead and Other Heavy Metals: Sensitive Population at High Risk, during 10-12 February 1998 under the aegis of CSIR and United States Environmental Protection Agency (EPA).

The workshop aimed at assessing the impact of heavy metals on human health specially on women, developing concepts and growing children and suggest strategies to combat their exposure and health risk. The main objectives were: to assess the present status of heavy metal poisoning; to review the current approaches in exposure assessment and monitor-



Demonstration of the technique to measure blood lead level using a portable blood lead analyzer, LEADCARE



Dr R.K. Bhandari, Head, ISTAD, CSIR, delivering the Presidential Address during the Indo-US-Workshop on Lead and Other Heavy Metals : Sensitive Population at High Risk. Sitting on dais (from left) are : Dr N.K. Ganguly and Dr P.N. Viswanathan

ing of health effects; to identify the predisposing factors, and; to come up with recommendations/policy decisions.

The workshop was attended by eminent scientists from various national research institutions, universities and government regulatory agencies like the Ministry of Environment and Forests, Ministry of Health, Indian Council of Medical Research and Pollution Control Board. The faculty for the workshop comprised of experts from India and USA.

During the inaugural function, Dr G.L. Kimmel from United States EPA, Co-ordinator of the workshop, said that the adverse effects of heavy metals exposure on the human health are of great concern in the present context. He also gave a brief genesis of the workshop.

Dr N.K. Ganguly, Prof. & Head, Department of Experimental Medicine and Biotechnology, Post Graduate Institute of Medical Edu-

cation and Research, Chandigarh, in his inaugural address laid stress on the need for regulating the level of heavy metals in the atmosphere so that their level in eatables is reduced as has been done by the Centre for Disease Control (CDC) in USA. He said that cases of heavy metal poisoning have been reported in the recent past from our country. In spite of stringent laws made to combat pollution, no regular monitoring system for the level of heavy metals is in existence so far. Also, owing to prevalence of various predisposing factors like iron deficiency, zinc deficiency and protein malnutrition, the influence of such factors on the severity of heavy metals poisoning in clinical cases is yet not clear. He also touched upon the report of arsenic pollution in West Bengal. Emphasizing the need to discuss the role of genetic susceptibility and organ toxicity markers during the workshop, he expressed that such effective outcome is only possible by link-up between different agen-

cies and experts as is being followed in this workshop.

Earlier, welcoming the guests and trainees, Dr P.N. Viswanathan, Deputy Director, ITRC, and Convener of the workshop, discussed the changing trends of metal toxicity. He stated that this discipline has gone molecular in the last five years.

Dr R.K. Bhandari, Head, International Scientific Technical Affairs Directorate (ISTAD), CSIR, in his presidential address lauded the role of ITRC and the relevance of such international workshops. Describing the existing pollution problems and their effect on future generations, he talked about the vulnerability to the effect of pollutants on women/children in socio-economically weaker sections of the society. He laid emphasis to conduct joint research and sharing of knowledge and data to combat the ill-effects on health by these metals. He laid stress on developing simple and cheap diagnostic tools for common men so that they can themselves measure and diagnose the ill-effects and exposure level of such metals. He hoped that the recommendations of this workshop will be valuable for the regulatory and government agencies.

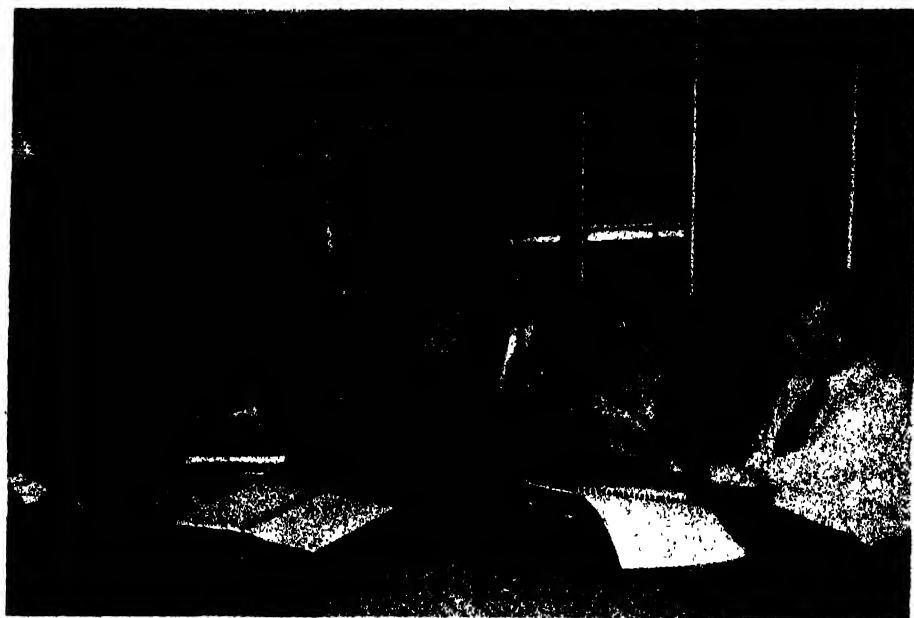
Dr P.K. Seth, Director, ITRC, gave the genesis of the workshop and stressed on the need for strict monitoring, risk assessment and prevention strategies regarding impact of heavy metals on health. He highlighted the contributions of ITRC in carrying out studies in the field of toxicity of metals like manganese, cadmium and lead.

Later, the experts from USA and India delivered lectures on various aspects of heavy metals toxicity, their state-of-the-art monitoring and therapeutic aspects, and nutritional/socio-economical factors in-

fluencing the toxicity. Experts from US and India participated in three Work Group discussions and made the following recommendations.

Recommendations on Exposure and Monitoring

- To conduct surveys for assessing the prevalence and pathways of exposure and also predominant sources of exposure to arsenic, lead, manganese and mercury.
- To identify, develop and validate biomarkers/bioindicators of early changes that would indicate population at greater risk to the toxicity of these metals.
- To develop sensitive methods and instruments for monitoring biological and environmental samples for these metals.
- To undertake country wide survey in Indian children and pregnant mothers for blood lead levels using the Portable Lead Care Instrument, developed by CDC, USA.



Work Group Discussion on Health Effects in progress during the Indo-US-Workshop on Lead and Other Heavy Metals : Sensitive Population at High Risk

Recommendations on Health Effects

- To standardize protocols and methodologies for identification, evaluation, analysis and reporting of health hazards through interaction and communication between various institutions at the national level.

Recommendations on Intervention and Prevention

- To generate baseline data for assessing the magnitude of health hazards owing to heavy metals.

- To monitor consumer products for metal contents.
- To establish poison control centers nearby government hospitals in big cities for handling such cases, and
- To develop safe and effective pharmacological agents which can be used in the prevention of toxic effects of these heavy metals. □

First Workshop on Utilization of Patent Information in R&D and Industry

THE first workshop on Utilization of Patent Information in R&D and Industry was jointly organized by the National Institute of Science, Technology and Development Studies (NISTADS), New Delhi, and National Information System for Science and Technology (NISSAT), Department of Scientific

and Industrial Research (DSIR). The workshop aimed at: Generating awareness on the importance of patent information in R&D and industry in the emerging economic environment; Dwelling upon the sources of patent information and quality search methodologies including use of CD-ROM/Internet based patent

information systems in India and abroad, and; Highlighting the application and utilization of patent information for decision-making in R&D and industry through specific case studies.

A total of forty-five participants from industry, S&T agencies and de-

partments, national R&D institutions and universities attended the workshop. Some of these organizations included; Ranbaxy Research Laboratories; Johnson & Johnson; Lakhanpal National Ltd; Bharat Petroleum Corporation Ltd; ONGC; IPCL; Dabur; CMTI, Bangalore; Department of Chemicals and Petrochemicals; Department of Electronics; Department of Atomic Energy; DSIR; DRDO; CSIR; NRDC; CMRS, Dhanbad; NEERI, Nagpur; RRL, Bhubaneswar, CEERI, Pilani; NCL, Pune; CLRI, Chennai; CFTRI, Mysore, Centre of Biochemical Technology (CBT), New Delhi; National Institute of Pharmaceutical Education and Research, Mohali; Defense Institute of Physiology and Allied Sciences, New Delhi; High Energy Materials Research Laboratory, Pune; Interim Test Range, Chandipur; Naval Science and Technology Laboratory, Vishakapatnam; Instrument Research and Development Establishment, DehraDun; IIT, Delhi and Bombay; Jadavpur University, Calcutta, and; the University of Delhi.

The main themes of the workshop included:

- Basic concepts of patent information — what is patent information, why patent information is important, what is structure of a patent document, who needs patent information, how and when to access patent information, patent information and agreement on Trade Related Aspects of Intellectual Property (TRIPs).
- Sources of patent information — national/international/private popular patent databases, on-line/off-line/CD-ROM based patent information and Internet.

- Search methodologies — type of searches, search input and output/quality, search timings and costing, patent classification, interactive demonstration of CD-ROM based search.
- Patent information, a strategic R&D tool and case studies — identifying trends in technology, research opportunities for technology development, active players and competitors; other uses of patent information in decision making.

Welcoming the participants, Dr A. Lahiri, Adviser, NISSAT, DSIR, distinguished between patents, patenting and patent information. According to him, the focus of NISSAT's activities relating to intellectual property is on patent information and not on patenting. This is the first programme being organized on patent information and the message will be spread in other parts of the country by organizing separate workshops.

According to Dr Ashok Jain, Director, NISTADS, the patent information can be used for a variety of purposes. Some of these are related to identification of technological trends, competitors, owners of technology and active research groups in the field. NISTADS is willing to cooperate with the participants who might like to undertake such case studies on topics of their interest, he said.

The workshop was inaugurated by Dr R.A. Mashelkar, Director General, CSIR and Secretary to Government of India, DSIR. Dr Mashelkar congratulated NISSAT and NISTADS for taking this timely initiative. He expressed his satisfaction regarding the contents of the programme and hoped that the participants would gainfully utilize the

tools and techniques of accessing the patent information. He shared with the participants the recent investigations by a group of scientists from IEEE, USA, regarding the discovery of solid state diode detector device which was used by Marconi in first transatlantic wireless communication. The device was in fact invented by Professor Jagdish Chandra Bose. The invention was published in the Proceedings of the Royal Society, London, on 27 April 1899, over two years before Marconi's first wireless communication. Bose did not take patent on the invention. The patent was taken by Marconi. The ignorance about patents as such continues 100 years later today in the country.

Shri V.K. Gupta, Scientist, NISTADS, while extending the vote of thanks, said, "More we learn about the subject of intellectual property, more we find that it influences different spheres of our daily life. There is a need to get acquainted with the emerging issues like protection of databases, computer software and biodiversity".

Shri V.K. Bali, Technical Director, Patent and Know-how Information Division of National Informatics Centre (NIC), delivered a talk on basic concepts of patent information. Shri D.P.S. Parmar, Assistant Controller of Patents & Designs, Patent Office Branch, New Delhi, shared his expertise on sources of patent information including national, international, private databases as well as those based on CD-ROM and internet. Shri M. Waicker and Dr Anish Mahendru made a presentation on chemical abstracts STN information and the services of patent information databases provided by

STN. Shri S. Arun presented the salient features of Derwent patent databases, their availability and cost effectiveness.

Dr M.P. Bhatnagar elucidated the basic concepts of national and international patent classification and codes highlighting the importance of classifying the patent information. Shri C.M. Gaiind, Deputy Manager, National Research Development Corporation, explained different search methodologies for accessing the patent information, in particular, using keywords as one of the indicators for making patent searches.

The presented case studies amply demonstrated the use of patent information for decision making. Shri V.K. Gupta, presented the case study on Fullerenes — emerging trends and technological opportunities. The field of fullerenes was chosen in view of its importance as a breakthrough discovery in recent times. The study indicated that the patenting activity in this field grew rapidly since 1992 (from 2 in 1992 to 41 in 1994 and 21 in 1996). Most patents in this area were owned by companies. The thrust areas of different companies were identified. Shri K.C. Garg, Scientist, NISTADS, presented the case study on patenting activity in the field of biosensors. The case study on use of patent information in understanding the scope of the existing patents and utilizing the patent information in determining the topic of research was jointly prepared by Dr K.C. Gupta and Dr Pradeep Kumar from CBT. The study on Universal support for DNA and RNA synthesis was presented by Dr Gupta. The case study on turmeric patent was presented by Shri R.K. Gupta, Scientist, Intellectual Property Management Division, CSIR, New Delhi. It

referred to the experience of CSIR in successfully opposing a US patent on turmeric. Shri V.K. Bali and Shri J. Thakur from NIC presented the case study of patent search methodology. It defined a patent document and the usefulness of a patent search. The paper described the search methodology step by step.

International Training Course on Chromatography and X-ray Crystallography

THE Indian Institute of Chemical Technology (IICT), Hyderabad, has organized two international training courses on Chromatographic techniques and tools and X-ray crystallography for molecular structure determination during 2-13 and 16-27 February 1998.

The faculty for both the training courses comprised of experts from universities, industries and IICT.

The training course on chromatography was inaugurated by Dr C. Ganguly, Director, Nuclear Fuel Complex, Hyderabad. Dr K.V.

The search parameters and contents of major patent databases like CAS-SIS series of USPYO, ESPACE-ACCESS of the EPO, and EPIDOS of the EPO were detailed.

The course was found extremely useful by the participants. □

Raghavan, Director, IICT, welcomed the participants and highlighted the importance of sharing the specialized expertise by the developing countries. The international course covered the various aspects of chromatography and application of TLC, GLC, HPLC and GC-MS. Intensive hands on experience in the operation, quantification and interpretation of data obtained by different chromatographic techniques was provided to the participants from Egypt, Libya, Sri Lanka and India.



Participants of the International Training Course on Chromatography seen with Dr G.S. Sidhu, former DG, CSIR; Dr K.V. Raghavan, Director, IICT, and Dr Sajid Husain (Seated 4th, 5th and 6th from left respectively)

The X-ray crystallography course was inaugurated by Dr G. Thyagarajan, Scientific Secretary, COSTED Secretariat, Chennai. He highlighted the significant applications of X-ray crystallography in organic synthesis and allied disciplines. The training course covered fundamentals of X-ray crystallography, crystallization process, crystal properties, preliminary screening, evaluation and crystal mounting, data measurement, collection and reduction, methods of chemical structure determination, refinement and analysis and new concepts for macromolecules. The most attractive part of the course was the benchwork experience provided to the participants from Sri Lanka, Syria, Poland and India on three dimensional crystal structure determination. □

HONOURS & AWARDS

Dr T.S.R. Prasada Rao

DR T.S.R. Prasada Rao, Director, Indian Institute of Petroleum (IIP), DehraDun, has been awarded the Dr K.G. Naik Gold Medal for the year 1996 by the



Maharaja Sayajirao University of Baroda, for his outstanding contributions to the area of Catalysis. □

The Gold Medal was awarded to him at the annual convocation of the university held on 8th March last.

Dr Prasada Rao was also recently honoured with the Kamal Kumari Award, Om Prakash Bhasin

Award, FICCI Award, Catalysis Society of India's Eminent Scientist Award and the Doon Ratna Award in recognition of his contribution to science, especially in the sphere of petrochemicals and catalysis. □

ANNOUNCEMENTS

Training-cum-Demonstration Programmes at CGCRI's Naroda Centre

THE Central Glass & Ceramic Research Institute's Naroda Centre proposes to conduct the following Training-cum-Demonstration Programmes and Capsule Courses as part of its Human Resource Development activities during the year 1998-99:

S. No.	Course		Time Schedule
Training-cum-Demonstration Programmes			
1.	Chemical Testing of Ceramic Raw Materials	Rs 5,000.00	13-17 July 1998
2.	Production of Glazed Roofing Tiles	Rs 5,000.00	27-31 July 1998
3.	Physical Testing of Ceramic & Refractory Raw Materials	Rs 5,000.00	17-21 August 1998
4.	Production of Acid Resistant Bricks & Tiles	Rs 5,000.00	14-18 September 1998
5.	Production of Wall Tiles	Rs 5,000.00	23-27 November 1998
6.	Making of Matt Glazes for Crockery & Tablewares	Rs 3,000.00	7-9 December 1998
Short Term/Capsule Courses			
1.	Ceramic Raw Materials/Properties & Uses	Rs 1,000.00	3 August 1998
2.	Processing and Grinding of Non-Plastic Raw Materials	Rs 1,000.00	4 August 1998
3.	Different Types of Ceramic Bodies	Rs 1,000.00	1 September 1998
4.	Ceramic Fabrication Processes	Rs 1,000.00	11/16 November 1998
5.	Medium Temperature Ceramic Glazes	Rs 1,000.00	16 December 1998
6.	Ceramic Firing and Firing Schedules	Rs 1,000.00	6 January 1998
7.	Defects and Remedies in Ceramic Bodies and Glazes	Rs 1,000.00	21 January 1998

Interested candidates are requested to register themselves for the specified programmes in advance. For further information please contact:

Dr K.N. Maiti,
Scientist-in-Charge
Central Glass & Ceramic Research Institute, Naroda Centre,
168 & 169, Naroda Industrial Estate, Ahmedabad-382 330
Phone: (079) 2823345, Fax (079) 2822052. □

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CSIR NEWS

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CRR I signs MoU with RMIT, Australia

THE Central Road Research Institute (CRR I), New Delhi, has entered into an agreement with the Royal Melbourne Institute of Technology University (RMIT), Australia. The Memorandum of Understanding was signed by Dr Arun Kumar, Prof. and Head, Department of Civil and Geological Engineering, RMIT, and Dr S.M. Sarin, Acting Director, CRR I, in the presence of Shri P.K. Nanda and Shri A.V.S.R. Murty of CRR I. The MoU was based on discussions held between Dr Arun Kumar, and Dr Sarin and Senior Scientists of CRR I during a visit of former to CRR I on 30 March 1998.

The MoU assumes significance, as the participation of private industry is being sought by the Government of India for infrastructure facilities including transport infrastructure development and maintenance of road networks in India.

RMIT with its expertise in education, training and research programmes is committed to transfer knowhow and technology to indus-

try throughout the South East Asian Region. CRR I is a pioneer R&D laboratory having special interest in innovative highway technologies, instrumentation and transfer of know-how to industry, particularly in South East Asia Region.

The MoU covers staff development and exchange, education and training, joint research projects, interaction between industry and user departments, provision of intellectual property and initial action plan. The initial action plan includes areas of particular interest to CRR I such as:

- Exchange of research information and R&D studies in the area of chip sealing and other seal-coat practices for providing black top to pavements in the rural areas and low volume roads, and to develop technology for those roads which presently require surface-covering through water-resistant surfaces.
- Development of utility guidelines for multigrade bitumen in India and the assimilation of Indian and

Australian experiences in the background of globally acceptable practices.

- Development of design curves for higher range of load applications beyond the present modified curves of 30 million standard axles for the flexible pavement practices as per IRC guidelines.
- The development of geotextiles including jute-based geotextiles for utilization in roads and highways especially in rural and command areas. This will have technology transfer component for developments in jute-based technology made at CRR I.
- Development of low-cost design for bridges in rural areas.
- Pavement management systems.
- Road maintenance policies and technologies.
- Project preparation for road projects.
- Roller compacted concrete pavement using industrial waste materials.

- Modulus of granular materials in flexible pavements.
- White topping on flexible pavements.
- Noise pollution and noise barriers.
- Landslide mitigation.
- Intelligent transport system.
- Road safety audits.
- Quality assurance system.
- Use of marginal and industrial waste materials in road and embankment construction.

The MoU involves visit of CRR scientists to Australia and vice-versa at a later stage for the mutual benefit of both the countries. □

CSIO signs MoU with the Government of Sikkim

IN the first joint venture of its kind in India, a Memorandum of Understanding (MoU) has been signed between the Central Scientific Instruments Organisation (CSIO), Chandigarh, and the Government of Sikkim on 7 April 1998 to set up an industrial training centre in this north-eastern state.

The institute, to be christened as the Advanced Technical Training Centre (ATTC), will be set up at Bardang near Gangtok and will be based on the pattern of Indo-Swiss Training Centre (ISTC), Chandigarh. ISTC, a part of CSIO, is engaged in imparting technical training for filling up the gap between the engineer and the skilled worker. Established in 1963, it offers Diploma/Post-Diploma courses in various disciplines.

The project will be executed on turn-key basis by CSIO. The total cost of the project, to be implemented in phases, is estimated at Rs 400 million. This includes Rs 300 million for equipment and training aids and Rs 100 million for buildings. The first year of the project involves an expenditure of Rs 50 million. Real estate is the responsi-

bility of the state government, whereas the technical and other training paraphernalia will be provided by CSIO.

The training to be conducted at ATTC will offer four-year courses in Manufacturing Technology, Mechatronics and Industrial Automation, and Die and Mould Making, all of which are already available at ISTC. The intake will be 45 students per year and the minimum qualification will be class X. The centre will start

functioning in September/October 1998. While some staff members from ISTC will be sent on deputation there, others will be recruited locally and provided training.

The Sikkim Education Minister, Shri K.N. Rai, visited ISTC-CSIO during 17-18 May 1998 to inspect the available facilities and the training being provided by ISTC, so that all the necessary help can be provided to ATTC.

According to Prof. S. Mohan, Director CSIO, CSIO has accepted the challenge of setting up this training centre at Bardang. He hoped that with the financial and moral support from the Government of Sikkim, the ISTC-CSIO staff will make this dream come true. He also talked about the possibility of some mutual training programme between the institutes of technology in Australia and ISTC-CSIO. ISTC is also likely to be considered as a central facility for training the polytechnic teachers, he said.



Faculty members of ISTC giving demonstration of an instrument to Shri K.N. Rai, Sikkim Education Minister

While emphasizing the requirement of Sikkim in various other areas, e.g. food processing, medicinal plants, solar and wind energy, hydro-power generation, Prof. Mohan felt that along with CSIO many other CSIR laboratories could also be involved in the development of this state under the motto "TEAM CSIR".

Shri P.S. Malhotra, Principal, ISTC, described the practical-oriented training pattern being adopted at ISTC. Based on the feedback from industry, the facilities are upgraded from time to time so as to make them relevant to industry. The same pattern should very much suit the Government of Sikkim, he said.

Shri K.N. Rai, was quite optimistic about ATTC serving not only the state of Sikkim but other north-eastern states as well in the times to come. He appreciated ISTC for its strength in different fields and also CSIO for its significant contributions in R&D. A lot of development work has been done in Sikkim since 1975 when it became a part of this great land, India, he said. The state is laying stress on development in education, agriculture and eco-friendly projects. An all around development has to be considered to survive in the new competitive world. The state of Sikkim will extend all possible help to ISTC-CSIO in making this challenging project a success, the minister assured. □

CSIR Vice President's Press Conference at NAL

DR Murli Manohar Joshi, the Minister for Human Resource Development and Science & Technology and Vice President, CSIR, who was present during both the days (11-12 May 1998) of the CSIR Directors' Conference held at the National Aerospace Laboratories (NAL), Bangalore, highlighted his Ministry's national S&T agenda while addressing a press conference on 12 May 1998. The key elements spelt out by Dr Joshi regarding his Ministry's broad strategy were: S&T for the common man; competitiveness of the Indian industry; value addition to endogenous resources and attaining global leadership. He also talked about his Ministry's resolve to evolve and implement an action plan to meet the challenges of the next millennium.

Dr Joshi announced his support for NAL's SARAS multirole aircraft which will be particularly useful for transport in North-East India. The Minister assured the correspondents present there that SARAS would definitely fly by the turn of the century. "If we try hard enough, we can surely make it fly!", Dr Joshi declared.

Spelling out his national S&T vision for the country and commenting on specific R&D programmes being undertaken by CSIR, the Minister talked about CLRI's contributions to the leather sector in addition to the NAL's SARAS programme. According to him, we need to evolve new strategies to expand the Rs 60,000 million leather export market and realise greater value addition. He also explained how the leather industry had the potential of

generating employment for rural women.

Dr Joshi dealt with the need to tap India's knowledgebase in herbal medicines and Ayurvedic drugs. "We must develop standardized drugs and market them internationally", he said. He also spoke strongly about the need to combat bio-piracy. "Our plant wealth worth billions of dollars is being taken away. We must stop this indiscriminate exploitation of our national wealth and the destruction of our bio-diversity", he said.

The dominant theme in the Minister's statements was the need for India to use its S&T knowledgebase to become a front-ranking nation occupying its rightful place in the world order. He asked how India could realise its full potential in S&T. "We hope to evolve a national plan for this in consultation with other Ministries and evolve strategies to reduce our vulnerability due to a Rs 300,000 million plus oil import bill. For food security, technologies must be developed to tap our biodegradable resource like the

Bangalore Declaration

THE participants of the Directors' Conference signed a declaration — Bangalore Declaration — expressing their dedication to the nation. The Declaration reads:

**India matters to us
It is our endeavour that
We shall matter to India, more
and has been reproduced at
the last page of this issue.**

Dr Mashelkar unveils the Foundation Stone for 'Santrupthi'

DR R.A. Mashelkar, DG-CSIR, unveiled the foundation stone of 'Santrupthi', the proposed Central Food Technological Research Institute (CFTRI), Mysore's liaison office at the campus of the National Aerospace Laboratories (NAL), Bangalore, as part of the 'CFTRI-NAL Synergy'. All CSIR Directors, assembled at NAL to attend the CSIR Directors' Conference, were present on the occasion.

The guests were served banana juice (a new CFTRI product) and snacks on biodegradable plates (another CFTRI product).

Dr V. Prakash, Director, CFTRI, welcomed the gathering and expressed his happiness at the new NAL-CFTRI initiative. Dr T.S. Prahlad, Director, NAL, reciprocated the sentiment and offered Dr Prakash the first HANSA so that he could commute comfortably between Bangalore and Mysore. □

new plates developed by CFTRI in tune with the Indian tradition of eating food out of leaves. The future wars will be economic wars. We must market Indian brands technologically and girdle our loins to become economically strong", Dr Joshi said, adding that he expected CSIR to play a major role in this regard.

The press conference strongly reaffirmed the Government's recognition of the role that S&T can play in generating national wealth, and of its faith in Indian scientists. □

Industries Get-together at CECRI's Mandapam Unit

THE Central Electrochemical Research Institute (CECRI), Karaikudi, organized a one-day Get-together with industries, in the recent past, at its Corrosion Testing Centre of the Mandapam Unit, with a view to popularizing CECRI technologies among the entrepreneurs of Ramnathapuram and Sivaganga districts and also to evaluate how these districts can be made industrially well grown. The Get-together had a good response from the industries and academic institutions of Ramnad and Sivaganga districts.

About 75 participants representing small and tiny industries, and academic and research institutions attended the Get-together.

Dr G. Subramanian, Scientist-in-Charge, Corrosion Testing Centre, CECRI Unit, Mandapam, welcomed the audience. Shri B. Sathyanandham, CECRI, Karaikudi, introduced the delegates.

Dr R. Vijayavalli, Deputy Director, CECRI, Karaikudi, in her presidential address, said that the research institutions should widely publicize their activities so that their innovations can be used by industry leading to industrial growth of the country. Ramanathapuram district is not only an industrially backward district but also has vast coastal line. If the entrepreneurs of this district come forward to start industries using CECRI's technologies, CECRI will extend all possible help to them. Highlighting CECRI's activities, she said that CECRI has entered the global market to sell its technologies.

Shri M.P. Kanakasabal, Additional Chief Engineer, Chennai Port

Trust, Chennai, while delivering his inaugural address, stressed upon the need for adopting CECRI's anticorrosion technologies to reduce the damage owing to corrosion. He also emphasized that the Maintenance Engineers should work in close co-ordination with research institutions for proper upkeep of machinery, structures and bridges, and also to enhance the service life of the structures, bridges, jetties, piles and platforms, both in submerged and atmospheric exposure conditions. He suggested that suitable anticorrosion technologies should be utilized, right at the time of the installation. He also talked about the successful utilization of CECRI's anti-corrosion technologies for the Chennai Port Trust installations.

Dr A.C.C. Victor, the Officer-in-Charge, Regional Centre of CMFRI, Mandapam Camp, released the Souvenir brought-out on this occasion. He also lauded the role played by CECRI in serving the nation for industrial development.

Shri A. Arumugam, General Manager, District Industries Centre, Ramanathapuram, released the technical notes on CECRI technologies and also declared open the Exhibition on CECRI Technologies. While lauding the contribution of CECRI all over the country, he observed that in spite of many subsidies being offered to the entrepreneurs to start industries in Ramanathapuram, they showed more interest in trading and business.

Dr T.M. Balasubramanian, Scientist, CECRI, Karaikudi, Dr K. Rama Rao and Dr P.V. Subba Rao, Scien-

tists, CSMCRI's Mandapam Unit and Shri V.R.C. Pandiyan, President RADISTIA, felicitated the function.

Shri S. Palraj, Scientist, CECRI's Mandapam Unit, proposed a vote of thanks.

The Get-together had two technical sessions. Dr V. Krishnan, Deputy Director, CECRI, Karaikudi, chaired the first session and Shri K.S.A. Gnanasekaran, Scientist-in-Charge of the CECRI Unit, Tuticorin, chaired the second session. In both the sessions, the R&D activities and technological excellence of various divisions of CECRI and the R&D activities and testing facilities of the CECRI Extension Centres were highlighted.

The panel discussion was chaired by Shri B. Sathyanandham. Shri V.R.C. Pandian, President of RADISTIA, inquired about the details regarding eroding nature of the stones, granite and marble in varied

environments. Dr N.S. Rengaswamy, Head, CSE Division, CECRI, and Dr Radhakrishnamurthy, Head, Electroducts Division, CECRI, provided information about this subject. Shri Prasath of M/s Computer Informatics, Ramnad, asked about electroforming of holograms using thin sheets of gold. Shri S. John, Head, IMF Division, CECRI, said that the process is under development in CECRI and the complete package will be ready within a period of six months. Shri R. Senthil Kumar of Sivaganga wanted to know about the role of CECRI in exploring the abundance and potentiality of granite stones in and around Sivaganga. Shri B. Sathyanandham explained that the studies at CECRI are aimed at electrochemical science and technological research, and not exploration of materials/minerals. Other agencies such as Geological Survey of India might be entrusted with this work.

Shri Hyther Ali of M/s N.S. Battery, SIDCO Industrial Estate, Uchipulli, wanted details about CECRI's technology on lead acid batteries which were provided by Shri Devasaghayam, Scientist, CECRI. Dr S. Ravikumar from Government Arts College, Paramakudi, wanted to know about a chemical which is a by-product of a biological reaction. Dr V. Krishnan, Deputy Director, CECRI, said that if the sample is given, efforts will be made to produce the chemical through electroorganic means.

At the end, Shri B. Sathyanandham, assured the delegates that CECRI's doors are open for all entrepreneurs interested either in consultancy work or licensing CECRI technology and that CECRI will help them in solving any of their technical problems. □

NATIONAL METALLURGICAL LABORATORY, JAMSHEDPUR R & D Highlights

WITH the present change in the economic policy and greater emphasis on generating extra-budgetary resources, the National Metallurgical Laboratory (NML), Jamshedpur, has intensified its efforts to provide market oriented R&D knowledge-base support to Indian industries for critical inputs so that the industries remain competitive through improved quality, affordable price and value-added products.

NML's efforts in mobilization of Extra Budgetary Resources (EBR) from users have yielded Rs 31.59 million during 1996-97, the period under report. A major portion of the fund has been utilized for creating

more facilities and enhancing capabilities of the laboratory. A sum of Rs 5.63 million was also spent from laboratory's reserve fund to meet the capital investment.

During this period, NML scientists bagged many prestigious awards like INSA Prize for Materials Science, Mascot National Award, Indranil Award and ARDB Award for excellence in R&D.

A total number of 131 research papers were published during the period, of which 41 were in foreign and 90 in Indian journals. Thirteen patent applications were filed. More than 150 research papers were presented by the scientists in various

national and international seminars/symposia/workshops, etc.

Efforts for strengthening the laboratory's facilities and expertise were made. During 1996-97, six workshops and three national level seminars were organised at the laboratory. More than 500 delegates drawn from over 150 private/public sector industries, research/academic institutes and representing various levels of management participated in these seminars/workshops. Their appreciation and continued interaction is of immense value to the laboratory. Further, the publications of these proceedings in a marketable 'book form', has not only enriched NML's total activities

but has also earned appreciation and drawn the attention of NML's target groups.

Technology Marketing

Ceramic tiles from iron ore tailings— M/s Kudremukh Iron Ore Co. Ltd (KIOCL) is generating huge amount of iron ore tailings. NML has developed the technology to produce floor and wall tiles from these iron ore tailings. Hundred market size tiles in glazed and unglazed form were produced and supplied to the company for market evaluation. NML has also provided the necessary techno-economic data to the party for setting up the commercial plant.

Column flotation technology — NML's Column Flotation Technology was demonstrated in the Madras Centre's 0.5 m dia column to M/s Bharat Gold Mines Ltd for the beneficiation of their gold ores and to M/s Gujarat Mineral Development Corporation Ltd, Ahmedabad, for the beneficiation of their fluor-spar.

Copper powder from waste solution — A process for recovery of copper powder from waste solution supplied by M/s Grishma Metal Technology, Mumbai, has been developed and demonstrated to the party. The powder made at the laboratory was found to be 99.85% pure after annealing. The process has been released to the company.

Recovery of nickel, copper and cobalt from complex Indian oxide mineral deposits — This is a collaborative programme with the School of Materials, University of Leeds, UK, for jointly developing a

process for extraction of copper, nickel and cobalt from laterite deposits of Sukinda valley, Orissa, India. The process route being investigated is pelletisation of laterite with gypsum and sodium sulphate, reduction roasting of the pellets to form matte, smelting of matte and refining of matte to separate metals using Mond's process under this programme.

Fundamental investigation on advanced ferrous alloys — The Indo-US research programme on advanced ferrous alloys involving several institutes and research establishments of our country, and being coordinated by NML, has been taken up during 1995-96 for a period of three years. The project aims at understanding the transformation characteristics of precipitation strengthened HSLA steel having an yield strength of 100 Ksi so that optimum combination of thermo-mechanical processing parameters could be suggested. The overall programme has eight aspects, viz. (i) Transformation during quenching and ageing of HSLA and ULCB steels; (ii) Influence of thermo-mechanical processing and austenite grain-size on the transformation, micro-structure and properties of HSLA and ULCB steels (iii) Solubility relations in HSLA steels; (iv) Transformation of very coarse-grained austenite and the resulting mechanical properties (changed to weldability of HSLA and ULCB steels); (v) Corrosion characteristics of advanced ferrous alloys; (vi) Evaluation of final properties — Fatigue and fracture properties of HSLA and HLCB steels, and; (vii) Evaluation of final properties — Formability properties of HSLA-100 and other high

strength steels, and (viii) Evaluation of microstructure and properties in HSLA forgings. Each aspect is being looked into jointly by at least two organisations.

Thrust Area Projects

Component integrity evaluation programme — Normally, an industrial component is designed to last for a period of 20-25 years. A large number of power plants, petroleum refineries, fertilizer, steel and chemical industries in the country, established in the fifties/sixties, are therefore on the verge of reaching this safe operating life. In order to maintain the industrial production at the present level, there are two options, viz, (i) set up new plants, or (ii) refurbish and extend the life of the existing units.

In this context, launching of Component Integrity Evaluation Programme (CIEP) in 1991 as one of the major thrust area projects at NML has been very timely. Spontaneous support came from Atomic Energy Commission (AEC), Bharat Petroleum Corporation Limited (BPCL), Indian Oil Corporation Limited (IOC), Steel Authority of India Limited (SAIL) and Tata Steel. Each one of them has contributed Rs 5 million. A matching grant of Rs 35 million came from the World Bank in the form of a soft loan repayable over a period of 20 years. All these have been invested not only to augment the existing test facilities but also to develop appropriate expertise in life assessment technology for critical components of ageing plants and equipment. The objectives of CIEP are: To develop new techniques and/or adapt existing meth-

ods for integrity assessment of ageing plants and structural components; To create a database on mechanical properties and microstructural characteristics of service exposed materials; To explore the potential of non-destructive techniques in characterizing mechanical properties and microstructural conditions; To develop predictive models for the growth of defects and microstructural changes as a result of service exposure to facilitate estimation of remaining lives.

In phase-I of CIEP, 16 generic projects in areas like creep, fatigue and fracture, non-destructive technique and computer software and modelling have been successfully completed. In addition, studies on five sponsored specific projects for Tata Steel, IOC, BPCL, SAIL and AEC have been conducted.

In phase II of CIEP, efforts have been made to share the knowledge gained through direct interaction with the industry by conducting seminars/workshops in the area of Failure Analysis, Mechanical Testing and Evaluation, Computer Applications in Materials and Metallurgical Engineering. The interaction has helped to define the objectives of the phase II of CIEP. The emphasis has been to solve industrial problems through failure analysis, remaining life assessment, non-destructive testing and stress analysis. In 1996-97, about 50 sponsor-specific studies on the above topics have been completed. These included: remaining life assessment and failure analysis of components like superheater tubes, Di-FPU distillation columns, turbine and boiler components, econo-

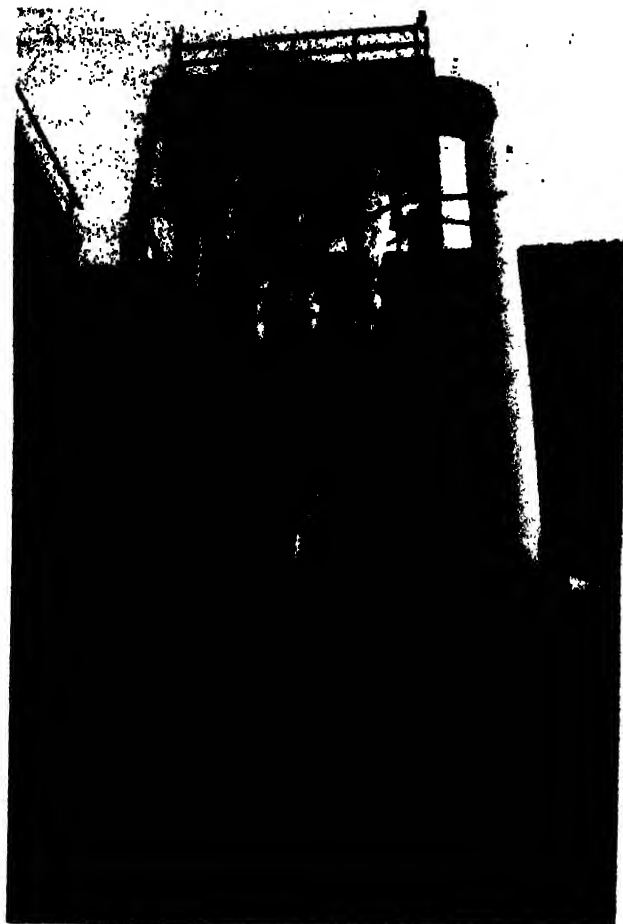
mizer tubes, wire rods, pulverizer mill shaft, transmission tower, high temperature casting, FCCU reactor plate, bow stackle and chain link buckels elevator, etc.

Processing of polymetallic sea nodules for recovery of valuable metals — Recent exploration and survey studies in the Indian Ocean have proved that the Central Indian Ocean basin has high potential reserves of these metals. NML has developed a process which consists of reduction-roast, ammonia leaching, solvent extraction and electrowinning (RR-AL-SX-EW) to recover copper, nickel and cobalt. The project is funded by the Department of Ocean Development (DOD) which will decide on the choice of technology for scale up from 100 kg nodules per day to a level of 2 tonnes per day, also subsequently the semicommercial demonstration plant to extract Cu, Ni, Co and Mn from sea nodules. Based on the bench-scale data (1 kg batch), the process was scaled up to a level of 100 kg nodules per day. The overall recovery of copper and nickel metals is 85% each and that of cobalt is 50% in five campaigns on 100 kg per day scale.

Sponsored Research

Design and development of gas cleaning systems for coke-based foundries of IISCO, Kulti and others — India is fast emerging as an important global player in the foundry sector of metallurgical industry as there is a decline in the production of castings in the developed countries due to service constraints on pollution.

There are about 6000 foundries currently operating, mostly as clusters, at Ahmedabad, Agra, Batala, Coimbatore and Howrah and most of these are coke-based. Normal stack emission from foundries ranges from 400 to 3000 mg/m³ of suspended particulate material (SPM). As per the directive of the Hon'ble Supreme Court of India, pollution has to be within the acceptable limits fixed by the Central Pollution Control Board (CPCB) which specifies that the SPM level in the Cupola emissions must not be more than 150 mg/m³. As a result of this stringent specification, most of the foundries are facing uncertainty about their existence. Many have already shut down. Considering the enormity of the problem from technical, economical and social angles, NML carried out considerable research and development work during the period under report and developed a less capital intensive and dry gas cleaning system of various modules/sizes in order to meet the requirement of Cupolas that ranges from 2 t/hr to 25 t/hr capacity. The technology has been successfully transferred on a turnkey basis, to save the closure of some units. Based on the design developed at NML, a few foundries of Howrah, West Bengal, have constructed Gas cleaning facilities in their Cupolas and obtained results within the specifications of CPCB. The first NML-CPCB demonstration pollution control unit was set up in M/s Crawley & Ray, Howrah. The second demonstration unit with NML technology was set up in M/s Shree Uma Foundry Pvt Ltd, Liluah (Howrah) in April 1996. The work was funded by the Indian Foundry



Tapping of Suspended Particulate Materials through the 'Gas Cleaning System' designed and installed by NML, Jamshedpur at the Foundry of Indian Iron & Steel Co., Kulti, West Bengal.

Association, Calcutta. In July 1996, NML's technology was utilized by Indian Iron & Steel Co. (IISCO), Kulti — a subsidiary of SAIL. The Central Growth Works (CGW) at Kulti has the distinction of having 12 Cupolas which are the oldest and the biggest in India. The foundries at CGW were threatened by closure in case the suspended particulate matter was not brought down below 150 mg/m^3 from the then existing level of nearly 2000 mg/m^3 before January 1997. NML undertook the design and installation of Gas Cleaning System (GCP) in three sets of these Cupolas on a turnkey basis. It is for the first time that NML undertook a turnkey job worth Rs 14.4

million and completed the same within six months from concept to commissioning. This has enabled the CGW-Kulti Works (SAIL), to meet the deadline set by the Hon'ble Supreme Court of India. The systems erected by NML are functioning efficiently and have met the CPCB's norms effectively.

Each module of the Gas Cleaning System has less weight and fewer capital equipment. The system consists of ducting to carry all the SPM in flue gas discharged from every Cupola, high pressure cyclones, ID fans, chimney, dust disposal unit and rotary air lock discharger to

give exhaust emission less than 150 mg/m^3 through stack. In most places where the foundries are located, there is a scarcity of water. Further, use of water has to be restricted since there are also limits on soil pollution from discharged effluents. Each of the system is tailor made for the specific foundry after analyzing the SPM level and the particle size distribution. The developed Gas Cleaning System is dry-type and therefore cheaper and cost effective. Maintenance cost is also very low. The entire plant can be operated through remote controls by few individuals. In India, few foundries have Gas Cleaning Systems. NML design can benefit all the foundries having Cupolas using coke as fuel.

Design and development of environment friendly cokeless Cupola for TIFAC (DST) — The normal Cupolas in India and in most other parts of the world are operating with coke as fuel.

An alternate strategy for mitigating environmental problems of the foundry industry is to substitute coke that is employed by industry for operating the Cupolas. Coke can be substituted by natural gas or low sulphur diesel oil. A proposal to this effect was made to TIFAC, DST, New Delhi and it received substantial financial support. A team of enthusiastic colleagues have not only designed a coke-free Cupola but also fabricated many subsidiary systems such as the grate, refractory balls, charging systems, safety devices, etc. An existing 225 mm ID Cupola was successfully converted within a very short time of six months to run on diesel or gas. The success of these trials have greatly encouraged the team and steps have already been taken to transfer the technology in association with M/s TATA-KORF to those who are in urgent need of the same.

Column flotation technology for the beneficiation of Indian ores/minerals — NML Madras Centre has successfully developed the column flotation for the beneficiation of Indian ores/minerals. The Centre designed and developed a 3" dia fully automated laboratory column flotation cell with which the Centre carried out extensive feasibility studies on various industrial minerals like copper, lead, zinc, gold fluorspar and iron ores both in the laboratory as well as at various plants. The Centre's offer to supply 3" dia column flotation system was

accepted by M/s NMDC. The Centre won the contract against stiff global competition. NML's column would be the first indigenous laboratory column to be commercially supplied in our country. The Centre's studies established the feasibility of adopting column flotation technology in the cleaner circuits for copper, lead, zinc, iron ores and fluorspar. The feasibility studies lead to the design of 0.5 m dia column. The Centre tested the pilot column in the rougher flotation circuits at Bharat Gold Mines Ltd (BGML), Kolar Gold Fields and demonstrated the applicability of the technology. NML pilot column is presently under test at GMDC, Kadipani, in the fluorspar beneficiation plant. According to the feasibility tests at the laboratory, six conventional flotation stages can be replaced by two columns series to achieve 97% grade of CaF_2 .

Beneficiation of limestone for the cement industry— The NML Madras Centre suggested to M/s ACC Ltd regarding selective flotation of silica for the limestone using amines and successfully demonstrated the technology for their Madukkarai limestone. The overall economics of the process at laboratory scale and the resulting benefits to the company were also evaluated. Plans are now underway to demonstrate the technology at 8-10 tonne/hour to the company.

The Centre recently established the feasibility of washing the limestone rejects of M/s ACC Ltd to recover the valuable carbonates therefrom at two tonnes/hour scale. The technologies of washing and reverse flotation are expected to improve the overall economy of M/s ACC's operations.

Paint-grade flaky stainless steel powder— The laboratory has developed a new process for making good quality flaky stainless steel powder which is quite fast and highly economical. The paint based on flaky stainless steel powder was coated on: bare mild steel belt; mild steel etched surface; mild steel phosphated, and rusted mild steel. The coating, so developed, is highly corrosion resistant and very effective for protection of structural steels in coastal regions.

Dry magnetic separation for quality production of refractory grade bauxite— Beneficiated bauxite conforming to the refractory specification has got tremendous industrial relevance. Beneficiation studies have been carried out on bauxite sample received from M/s INDAL, Calcutta, for their Durgamanwadi Mines, Maharashtra.

The objective of the present investigations was to explore the possibility whether the dry magnetic separation alone can reduce Fe_2O_3 and TiO_2 content in the concentrate to a level which can be achieved through the beneficiation following wet circuit.

Bench scale beneficiation studies on limestone samples— Limestone is one of the most mined and widely used industrial raw materials. In order to look into the limestone beneficiation problem at Chaibasa Cement Works, Chaibasa, M/s ACC Ltd sponsored the project to the laboratory. The detailed characterization and bench scale flotation studies have been undertaken on the three limestone samples provided to the laboratory to have a clear understanding of the flotation behaviour of different samples and to establish the reasons for their poor plant performance. Based on

the inplant studies, suggestions were made for the necessary modifications and maintenance in the plant of Chaibasa Cement Works.

Reduction of alumina in iron ore and utilization of fines in sintering— The project has been sponsored by DST, New Delhi, under TIFAC programme. The basic objective is to prepare a status report with specific suggestions on the subject. In this context, a committee has been set up with NML as the nodal agency with members from SAIL, MECON, TISCO, RRL (Bhopal), KIOCL and IBM. Further work is in progress.

Recovery of copper powder from copper containing waste solution— This is a new approach for the recovery of copper powder from waste solutions which mainly contain higher concentrations of Cl^- ions (200 g/l) and NH_3 (140 g/l) along with copper (130 g/l). The process developed by NML recovers copper metal in the form of electrolytic copper powder from this solution by the process of electrowinning. During the process, NH_3 gas is taken out from alkaline solution and collected as a by-product. The excess free Cl^- ions are removed from the solution before electrowinning. The powder made by this process is highly pure and meets the specifications laid down by MPIF.

Development of low-cost bamboo-polymer composite for structural applications— The project has been sponsored by ARDB to NML and IIT, Kharagpur. Bamboo samples were treated with alkali solution and phenol-formaldehyde polymer was incorporated in the treated bamboo. Further work is in progress.

Production of Chrome-T— NML has developed a process for

the production of Chrome-T from chromate effluent — a protective pigment used in paint industries. The developed process has the advantages: production of value added chrome pigment which is otherwise carcinogenic in nature; less energy consumption; low-cost of production, and no necessity for treatment to the generated effluent.

Acoustic emission studies of Horton spheres — In one of the Horton Spheres used for storing LPG of Bharat Petroleum Corporation Limited (BPCL), Mumbai, ultrasonic testing had revealed several defects in some of the plates. To check the integrity of the vessel, BPCL commissioned NML to carry out Acoustic Emission (AE) testing during hydrotest of the sphere. The recorded low pressure AE signals were found to be due to the crack faces in the reinforced concrete pillars used to hold the Horton sphere.

Collaborative Research

Development of ultra-pure nano-crystalline alumina — This is a collaborative project with Tata Steel aiming at the production of nano-crystalline ultra-pure alumina powder. These powders are used in advanced ceramics for high performance in applications such as heat engines, micro-electronic devices, cutting tools, envelopes for sodium vapour lamps, bioceramics, ceramic armours, etc. Under the project, alumina powder with 99.95% purity and size of less than 0.5 microns has been produced at the rate of 2.5 kg/day.

Deoxidation of low carbon micro-alloyed steel — This project has been undertaken in collaboration

with IIT, Kharagpur. Increasing demands for thinner sheet steels require higher cleanliness owing to surface defects caused by non-metallic inclusions. The objective of the project is to develop a process route for simultaneous decarburization/deoxidation, inclusion modifications of low and extra low carbon steel through induction furnace melting and rolling. The low and extra low carbon micro-alloyed steel melts were produced by melting low carbon steel scrap, 15-20% DRI and micro-alloying additives in basic induction furnace.

Thermochemical analysis of ferrochromium production process — NML developed a scheme based on a thorough thermochemical analysis of the chromite smelting process for lowering the silicon impurity (<0.3%) in the ferrochromium produced at TISCO's 30 MVA submerged arc furnace at Barnipal.

Adsorption-desorption of polysaccharides-g-actylamide copolymer on iron ore system — A three-year duration research programme in collaboration with the IIT, Kharagpur, has been undertaken with financial support from the CSIR EMR Division aimed at developing grant copolymers based on various polysaccharides and studying their flocculation efficiency in relation to settling and filtration of iron ore slimes from the SAIL and TISCO mines. The optimization of the flocculent quantity has also been envisaged through adsorption studies.

Evaluation of surface coating — undertook the project with Tata Steel to evaluate organic, inorganic and metallic coatings under laboratory conditions, industrial and marine atmospheres. The

coated panels supplied by Tata Steel were exposed at both industrial atmosphere in Jamshedpur and in marine atmosphere of Digha for collection of corrosion data. Electrochemical studies were also carried out and a report to this effect was submitted to Tata Steel.

Exploratory Research

Utilization of red mud sinter mix for iron blast furnace — Disposal of red mud, the caustic insoluble residues from bauxite, is a major problem all over the world. Prefeasibility studies on sintering using NALCO red mud sand as additive in the sinter mix for iron ore sintering were conducted for producing sinters acceptable to iron blast furnace. A detailed study is proposed to be carried out for optimization of various parameters like proportioning of raw material including red mud sand, moisture, mixing, basicity, bed height, coke breeze, etc. for finding out maximum quantity of red mud sand that can be utilized for producing sinters acceptable to iron blast furnace. The revised proposal along with the results of above test have been submitted to NALCO.

Recovery of sulphur from sulphur sludge — During the process of sulphuric acid manufacture, sulphur sludge is produced as the solid waste, which in turn leads to loss of sulphur besides causing environmental pollution problems. Exploratory studies were carried out for the recovery of sulphur from the sulphur sludge. The sample for the studies was received from M/s The Fertilizers and Chemicals Travancore Ltd (FACT), Cochin. A MoU has been signed with FACT for the development of technology to recover sul-

phur from the sludge. The project proposal has been submitted to DSIR, New Delhi, under PATSER scheme for partial funding.

Development of ferritic stainless steel— Ferritic stainless steel was developed for use as metal support in catalytic converter. Processing of alloy ingot to cold-roll a strip of 0.05 mm thickness with intermediate annealing and the process parameters were optimized.

Production of Aluminium Nitride— Aluminium nitride (AlN) was produced in the laboratory by: direct nitridation of aluminium, and carbothermal reduction and nitridation of Al_2O_3 . Nano crystalline AlN was made by this technique for the first time in India.

Improved fluid dynamic analysis of turbulent flow field and inclusion behaviour in a slab casting tundish— A three dimensional mathematical model has been developed based on finite volume technique with an improved (K-e) two equation turbulence model to simulate fluid flow phenomena in steel continuous casting (CC) tundish for slabs. An attempt has been made to resolve the near wall region in a more effective way by applying the concepts of low Reynolds number turbulence model. The model is designed to be executable in computer systems with preferably 32 MB RAM. Computed results describing the 3-D flow field and the residence time distribution (RTD) during the steady state operation were evaluated showing thereby that the characteristics of fluid flow behaviour within a tundish can be varied considerably with the use of flow control devices incorporating near wall effects. □

SEMINARS

National Seminar on Life Extension Strategies for Ageing Aircraft

A two-day meeting was recently hosted by the National Aerospace Laboratories (NAL), Bangalore, to discuss Life Extension Strategies for ageing aircraft. The meeting, sponsored by the IAF, AR&DB, AeSI and NAL, was held at the Systems Auditorium on 27-28 May 1998.

The Indian Air Force (IAF), with a large number of aircraft of Soviet origin, faces a special problem. Till the break-up of the Soviet Union, the problem of life extension of IAF fleets was essentially the concern of the Soviets; now this onus has fallen on the IAF. And with the Russians demanding very large sums of money for life extension exercises, it is no longer economically feasible to go to them.

The objective of the seminar was to debate and devise strategies which will enable IAF to undertake its own life extension programme.

At least half a dozen serving Air Marshals, including Air Marshal A.Y. Tipnis, the Air Vice Chief, attended the seminar.

Delivering the inaugural address, Air Marshal Tipnis voiced his concern about aircraft life extension and continued "This is a serious issue. We have many aircraft which are not merely ageing, but have already aged!" Expressing his confidence, he said that Indian genius will respond to this challenge.

Air Marshal S.S. Gupta, in his keynote address, echoed the Air Vice Chief's confidence about Indian capability. Recalling that the early years (1989-92) were the most

trying, Air Marshal Gupta said that the IAF had already overcome many challenges in life extension, making special mention of its successful AN-32 extension programme. "We have already saved millions of dollars by indigenous AN-32 life extension", he added. Air Marshal Gupta also talked about the need to evolve both long-term and short-term life cycle augmentation plans; of the special problems posed by corrosion; of the need to have efficient and transportable non-destructive testing systems; and the need to evolve advanced repair technologies.

Air Marshal G. Gururani (retd), who was in many ways the moving spirit behind the seminar, delivered an illuminating guest lecture which was notable for its package of recommendations. Some of the recommendations made by Air Marshal Gururani were: (a) formulate a longterm utilization plan for fleets (from the day of aircraft induction and not at the end of the aircraft's life); (b) create teams of flying and maintenance services to lay down statutory life extension guidelines; (c) nominate an empowered core group to evaluate proposals, and accord quick financial approvals; (d) form executive teams for individual life extension programmes; (e) introduce individual air frame tracking and life cycle management systems (especially for the MiG 29s and Su 30s); (f) adopt advanced NDE techniques, and (g) strain gauge all aircraft and components. "We need a considerably magnified effort in aircraft life extension; otherwise we

run the risk of utilizing very costly aircraft fleets sub-optimally", the Air Marshal warned.

Dr C.G. Krishnadas Nair, Chairman, HAL, also voiced the need for a national plan for aircraft life extension. He made the important point that life extension studies need not be restricted only to airframes but can also encompass aircraft engines and even avionics systems. Citing simple life extension studies, Dr Nair explained how an additional gain of 300 flying hours for even five

aircraft could cover the cost of buying a new fighter aircraft!

Earlier, Dr T.S. Prahlad, Director, NAL, in his opening remarks talked about the "imperative need" for all Indian aircraft agencies "to work together for life extension". He also assured the Air Vice Chief of NAL's "full support to the IAF".

Air Vice Marshal, K.B. Kurup welcomed the gathering.

Dr B.K. Parida, Head, Structural Integrity Division, proposed a vote of thanks. □

CBRI; pollution control technologies of NEERI, and food processing technologies of CFTRI.

One complete session was devoted to the deliberations by CSIR scientists on 23 March. The scientists who delivered talks were: Shri M.S. Virdi, Scientist I/c. PTC, Bhopal, on Food processing industry and aromatic and medicinal plants; Shri T.K. Ghoshal, Scientist, NML, on Pollution control in foundry industries; Shri S.N. Das Gupta, CBRI, on Low cost housing and building materials; Shri T.K. Mukherjee, CGCRI, on The rural potteries; Shri Arindam Ghosh, NEERI, on Pollution control and environment problems. In addition, Dr T. K. Dan, Scientist I/c. PTC, Calcutta, and Shri T.D. Nagpal, CSIR, New Delhi, discussed the competence and capabilities of CSIR laboratories in the changed scenario. The session was attended by a large number of delegates who came for the Congress and a few local entrepreneurs.

CSIR Exhibition at Siliguri

THE CSIR-PTC Calcutta, organized the exhibition 'CSIR Rural Technology' on request from the Department of Science & Technology, Government of West Bengal, during the 5th West Bengal Science Congress held at North Bengal University, Siliguri, from 21 to 23 March 1998. The CSIR laboratories/Institutions which participated in the exhibition were: CBRI, NML, CGCRI, NEERI, CMERI, NIS-TADS-Bankura project and CSIR Exhibition Unit, New Delhi.

The exhibition was inaugurated by Dr Shankar Kr. Sen, Minister In-charge for Power, S&T and Non-conventional Energy Sources. Others who accompanied the Minister were: Shri Ashoke Kr. Bhattacharya, Minister of Urban Development, Government of West Bengal; Prof. Deb Kumar Bose, Chairman, West Bengal Pollution Control Board and Vice-Chairman of West Bengal Council of Science & Technology; Prof. Subimal Sen, Secretary, DST, Government of West Bengal; Prof. Dilip Bose, Vice Chancellor, Burdwan University, along with Prof. R.G. Mukherjee, V.C. North Bengal

University. They took tremendous interest in CSIR technologies suitable for West Bengal, particularly the northern region of the State.

The technologies which evoked tremendous interest are: medicinal and aromatic plants like citronella and lemon grass; roses for rose oil; low-cost housing and building material technology developed by



Dr Sankar Kr. Sen, Minister Incharge for Power, S&I and Non-conventional Energy Sources, Government of West Bengal, visiting the 'CSIR Rural Technology Exhibition' at Siliguri

This session was presided over by Prof. Dilip Kumar Basu, Vice-Chancellor, Bardhaman University and the former Secretary to the Ministry of Science & Technology, Government of West Bengal. Dr Gouripada Datta, MLA from the re-

gion, was Co-chairman of the session.

The deliberations by CSIR scientists generated keen interest during the exhibition and several enquiries about CSIR technologies were received. □

CSIR participation in R&D India'98

CSIIR participated in R&D India'98 comprising an exhibition on recently developed technologies and a convention 'Converting R&D into Development' at Calcutta during 8-11 April 1998.

The CSIR philosophy, goals and mission, and its activities on the global platform were displayed during the exhibition 'technologies suitable for the entrepreneurs in the eastern region'. The technologies developed by various laboratories during the last few years were also displayed. The laboratories which participated were: CSIO; CIMAP; RRL, Jorhat; RRL, Bhubaneswar; RRL, Jammu; CLRI; CFTRI; CMERI; IICB; NML; CGCRI, and NAL. The exhibition material from PTC, Calcutta, was also put up along with these exhibits. Senior scientists from these laboratories interacted with viewers who were mostly representatives of the small scale industries in the vicinity of Calcutta. One of the major attractions of the exhibition was CSIR films show on TV. In addition to CSIR, the other major participants in this exhibition were: DBT, NRDC, DST, DRDO, TATA Steel, Saha Institute of Nuclear Physics. The exhibition was coordinated by the Unit for Science Dissemination in collaboration with Dr T.K. Dan, Scientist-in-Charge, PTC, Calcutta.

The exhibition and convention were inaugurated by Shri Joyti Basu, Chief Minister, Government of West Bengal. Among others present during Shri Basu's visit to the exhibition were: Dr R.A. Mashelkar; Prof. M.G.K. Menon; Shri Bikash Sinha, Director, Saha Institute of Nuclear Physics; Dr Ashok S. Ganguly, Chairman, ICI; Shri V.S. Ramamurthy, Secretary, DST, and Dr T.S. Prahlad, Director, NAL.

A brain storming convention 'Converting research into development' was also held during this period. Shri Joyti Basu was the Chief Guest on the occasion. Dr R.A. Mashelkar presented the Keynote Address on the first day of the convention. Others who spoke during the inaugural session were: Prof. Bikash Sinha; Dr Ashok Ganguly; V.S. Ramamurthy; Prof. M.G.K. Menon; Claude Detraz, Director, Institute National De Physique Nucleaire Ed De Physique Des Particules, France.

The second half of the convention was presided over by Prof. T.S. Prahlad, Director, NAL, who spoke on 'Interaction between Entrepreneurs and Laboratories'. Dr Prahlad's deliberations were followed by a colourful presentation by Shri M.S. Virdi, Scientist-in-Charge, PTC, Bhopal on 'Agrotechnologies of medicinal and aromatic plants developed by various CSIR laboratories and the post harvest

technologies from CFTRI'. This presentation triggered a lively discussion with the entrepreneurs and other interested parties from the region. Others who made presentations included: Dr N. Vithal, Chairman on Enterprises Selection Board; Shri S. Ramani, Director, National Council of Software Technology, and Shri Govind Sharma of NRDC. The main theme of this session was 'Towards Technology Driven Growth'.

The next session was chaired by Prof. Bikash Sinha. The presentations made during the session included one by Dr R.R. Hirwani of NCL who talked about the present R&D scenario in Maharashtra with special reference to Pune. The last session dealt with R&D in drugs, medicine and allied aspects. The dignitaries who spoke in this session were: Dr Sandip Basu, Director, National Institute of Immunology, New Delhi; Dr V.P. Kamboj, former Director and Emeritus Scientist, CDRI; Dr A.V. Rama Rao, former Director, IICT; Prof. P.N. Tandon, Emeritus Professor, Department of Neurosurgery, AIIMS, New Delhi. Dr S. Varadarajan, President, Indian National Science Academy and former Director-General, CSIR, presided over the function which had a Keynote Address by Dr Manju Sharma, Secretary, DBT. The industry was represented by Dr Ambica Banerjee, Research Manager, East India Pharmaceutical Works, Calcutta.

At the end of the session, a special presentation was arranged in which Shri R.K. Gupta, Scientist, IPR Unit, CSIR, spoke on the 'IPR — Indian Scenario'. □

TRAINING PROGRAMMES

Entrepreneurship Awareness Camp at Indo-Swiss Training Centre

A three-day 'Entrepreneurship Awareness Camp' was organized for students at the Indo-Swiss Training Centre (ISTC) of the Central Scientific Instruments Organization (CSIO), Chandigarh, with a view to motivating them for the entrepreneurial career.

The programme was sponsored by the Department of Science & Technology, Government of India, and was conducted by the Department of EDIC, TTTI, Chandigarh.

The programme was attended by over 60 final-year students from disciplines of Mechatronics and Industrial Automation, Die and Mould Making, and Instrument Technology.

Prof. B.S. Rathore, Head, EDIC Deptt., and the programme coordinator, stressed upon the concept of an Entrepreneurial Circle in which a Facilitator (Faculty member) from the concerned polytechnic and students can mutually discuss their ideas/problems and can then seek help/guidance from TTTI for sorting out their difficulties.

Dr R.P. Bajpai, Officiating Director, CSIO, who presided over the function, emphasized the necessity of setting up units by the students and thus contributing to the growth of the nation and solving the unemployment problem too.

Shri R.K. Jain, Senior Faculty Member of ISTC, expressed his gratitude for the programme conducted for the benefit of students and advised the students to utilize the inputs given to them during this programme.

Shri R.C. Arora, faculty member, ISTC, and local programme coordinator stressed that self-employment is the need of the hour and that students should take advantage of the available resources/facilities to make themselves successful entrepreneurs.

Experts from Academic, Financial and Banking Environment, and a Successful Entrepreneur interacted with the participants during various sessions.

The participants spoke highly about the programme and wished that such courses be organized at frequent intervals.

A vote of thanks was proposed by Shri R.C.Arora. □

DEPUTATION BRIEFS

Dr S. Narayanan

Dr S. Narayanan, Scientist F, Catalysis Division and Head, Education and Training Division, Indian Institute of Chemical Technology (IICT), Hyderabad, was deputed to France (Institut de Recherches sur la Catalyse and University of Montpellier); UK (The Open University, Milton Keynes), and The Netherlands (University of Twente) during 10 April-1 May 1998.

The visit was supported by the Royal Society of Chemistry (London) Journals Grant for International Authors, in recognition of his scientific contribution and also by Indo French Centre for the Promotion of Advanced Research (IFCPAR), New Delhi.

During his stay abroad, Dr Narayanan held discussions on the current collaborative programmes in the area of catalysis and also ex-



During the Entrepreneurship Awareness Camp at Indo-Swiss Training Centre, CSIO, seated on dais (from left) are: Prof. B. S. Rathore, Dr R. P. Bajpai and Shri R. K. Jain, and a view of the participants

plored the possibility of promoting fresh projects for funding by international agencies. Also, he delivered the following lectures on catalysis: Aniline Alkylation over Solid Acid Catalysts; Envirocatalysis, Solid Acid Catalysts in the Selective Synthesis of Alkylanilines, and; Layered Double Hydroxide supported Metal Hydrogenation Catalysts. □

HONOURS & AWARDS

Dr B. Mahipal Reddy

DR B. Mahipal Reddy, Scientist, Inorganic Chemistry Division, Indian Institute of Chemical Technology (IICT), Hyderabad, has been selected for Associate Membership of the Third World Academy of Sciences (TWAS), Italy. One of the major objectives of the TWAS is to help scientists in developing countries for promoting their research work by facilitating their regular visits to Centres of Excellence located in the third world. Dr Reddy has received this coveted recognition for his significant contributions in the area of catalysis.

Dr Reddy has a brilliant academic record and has received 'gold medal' in B.Sc. in 1979 and secured first position in M.Sc. in the year 1981. He did his Ph.D. work at IICT and obtained Ph.D. degree in 1986 from Osmania University.

He was a DAAD Fellow at the Institute of Physical Chemistry, Munich, Germany with Prof. H. Knoezinger (1988-89), Visiting Scientist at the State University of New York, Buffalo and Texas A&M University, College Station, USA (1993-95). He has also worked as Visiting Scientist at the Institute of Catalysis, Novosibirsk, Russia (1986). □

He is a recipient of CSIR Young Scientist Award in Chemical Sciences (1990) and Catalysis Society of India Young Scientist Award

(1993). He has published over 65 research papers. He has four Indian patents to his credit and has guided three students for Ph. D. degree. □

ANNOUNCEMENT

NAL-UNI LECTURE SERIES

Introduction to Finite Element Modelling

THE finite element method has emerged as the most powerful numerical and computational technique for the investigation of problems in engineering physics and mechanics. Professor J.N. Reddy of Texas A & M University, USA, is offering the course 'Finite Element Method' (FEM) for people with background in heat transfer, fluid flow and solid mechanics.

Prof. Reddy is one of the leading researchers in many front-line areas of computational mechanics, composites and smart structures. He has been invited under the TOKTEN (Transfer of Knowledge Through Expatriate Nationals) programme to visit the National Aerospace Laboratories (NAL), Bangalore, during 21 July-15 August 1998. The 4-day seminar 'finite element method' is being conducted under this programme.

The title course is being organized at NAL during 22-25 July 1998. The tentative programme is:

- General introduction
- Finite Element Models of 1-D Problems in Heat Transfer, Fluid Mechanics and Solid Mechanics: (a) Static problems, (b) Eigenvalue problems, (c) Transient Problems.
- Finite Element Models of 2-D Problems in Heat Transfer, Fluid Mechanics and Solid Mechanics: (a) Single-variable problems, (b) Interpolation theory, (c) Numeri-

cal Integration, (d) Modelling Considerations.

- Continuation of 2-D Problems: (a) Plane elasticity, (b) 2-D Viscous incompressible flows, (c) Plate bending.
- Nonlinear Problems: (a) FE Models, (b) Iterative Methods

Students, research scholars, scientists, engineers and technical managers who have an interest in computational mechanics and finite element modelling are eligible for the course. It is envisaged that Prof. A.V. Krishnamurty, IISc, Bangalore, and Dr G. Prathap, NAL, Bangalore, will assist Prof. J.N. Reddy by delivering special lectures during the course.

The course is arranged as a part of TOKTEN interaction, and only a nominal fee of Rs 500 (for four days) is to be charged. About 50 persons are to be accommodated in the course by registration.

For further details please contact:

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Shivakumar

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J. Sankar

Harsh

Chirich desai

R. N. Singh

Shivakumar

J. Sankar

S. S. Handa

Shivakumar

Sankar



TEAM-CSIR

Shivakumar

P. Sankar

P. Sankar

P. Sankar

R. N. Bhander

Shivakumar

Sankar

J. Sankar

Harsh

India matters to us
It is our endeavour that
We shall matter to India, more

K. S. Narank

Shivakumar

Sankar

J. Sankar

S. S. Handa

Shivakumar

Sankar

J. Sankar

Shivakumar

Sankar

J. Sankar

S. S. Handa

Shivakumar

Sankar

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CSIR NEWS

CRR-ECIL to develop instrumentation for automatic vehicle counting classification and axle load weighing

THE Central Road Research Institute (CRR), New Delhi, and Electronics Corporation of India Ltd (ECIL), Hyderabad, have entered into an agreement for the 'Development of an instrumentation system for automatic vehicle counting, classification and axle load weighing at normal highway speeds' to suit Indian vehicles and conditions. The project is being supported by the Ministry of Surface Transport

(MOST) (Roads Wing), and the Department of Electronics (DoE), Government of India. An MoU was recently signed by CRR, ECIL, MOST and DoE to this effect.

The objective of the project is to develop technology for design, engineering, testing and calibration of the product by CRR and ECIL jointly. ECIL will take up the commercial production of the product within one year of the successful completion of this project.



MoU for the development of an instrumentation system for automatic vehicle counting classification and axle load weighing at normal highway speeds to suit Indian vehicles and conditions being signed by the officials of CRR, ECIL, MOST and DoE

R&D at CFTRI

Biosensor for L-lactose

UNDER its Biosensor Development Programme, the Central Food Technological Research Institute (CFTRI), Mysore, has developed a microprocessor-based L-lactate biosensor and the know how is ready for commercialization.

Biosensors are modern analytical devices that function using a biologically active material, say an enzyme or a protein, in close contact with a detector, an electronic or electrochemical device, that translates the activity of the biological molecule into measurable electric impulses. These score over other conventional analytical methods such as gas chromatography or high pressure liquid chromatography in that they are accurate, specific, easy to use, rapid, more reliable and often do not require sample pretreatment. Biosensors have been used in various fields such as clinical diagnosis of specific diseases, pharmaceuticals,

environmental pollution monitoring, agriculture, defense, forensics, food processing, etc.

The lactate biosensor developed at CFTRI uses lactate monooxygenase (LMO) enzyme and is superior to the currently available biosensors which use either lactate oxidase (LO) or lactate dehydrogenase (LDH) enzymes. LO and LDH based biosensor devices have several disadvantages in terms of stability and electrode fouling which may cause rapid inactivation of the enzyme membranes. The CFTRI biosensor has none of these disadvantages and specifically suits the requirements of food and fermentation industries. It can be calibrated daily and has a life of about 2 months at room temperature before the membrane needs any change. It can measure 50-800 mg/100 ml of L-lactate in a matter of three minutes.

The biosensor is simple to operate and can also be used for monitoring spoilage in fruit products, taking L-lactic acid as an index of spoilage. Using the device, several samples of mango pulp have been successfully monitored for spoilage. Biosensors for detecting glucose, sucrose and organophosphate residues in food samples are in the advanced stage of development at the institute.

Environment-friendly Mosquito Coil

A safe and environment-friendly mosquito coil, using only plant-based materials, has been developed by the Central Food Technological Research Institute (CFTRI), Mysore, as an alternative to the syn-

thetic pesticide-based products available in the market. The synthetic compounds used in the popular commercially available mosquito repellent formulations such as mosquito coils, mats and vapourizers reportedly cause headaches, nausea and such other side effects. An increased awareness of these harmful effects has caused a shift in consumer preference towards safer and environment-friendly products.

The CFTRI's herbal mosquito repellent coil fits the bill perfectly in that all the used ingredients including binders/adjuvants and smouldering agents are from plants with known medicinal properties. Also, the coil has a pleasant fragrance and generates less smoke than other coils. Trials have indicated that the CFTRI formulation is more effective and its production cost is also less than the products currently available in the market.

The manufacturing units for these mosquito repellent coils can be established at rural and cottage level. The CFTRI technique is quite simple and uses locally available

plant materials and indigenously fabricated gadgets involving relatively lower initial investment. The process has already been released for commercialization.

Automatic Idli-making Machine

An automatic idli-making machine, capable of cooking 1000-1200 idlis per hour, has been developed at the Central Food Technological Research Institute (CFTRI), Mysore. The machine consists of an automatic batter dispensing unit, an automatic scooping mechanism to remove cooked idlis and an automatic cleaning-in-place system with electronic controls for temperature control, batter dispensing and counting of idlis. All parts coming into contact with the idlis are made of stainless steel, providing hygienic processing for large-scale manufacture of idlis. The machine leads to savings in time, energy and money, and also has a variable speed drive mechanism for varying the cooking time which helps in cooking different varieties of idlis. □

Blasting Research Activities at CMRI

THE mining scenario in India prior to 1979 was different when the project appraisals were based mainly on the techno-economic considerations ignoring environmental aspects. The situation has now changed completely and environmental protection is an integral part of the mining operations. Ever increasing usage of commercial explosives to meet enhanced demand of coal and minerals coupled with the sprawl of urbanization and increased human

sensitivity have made the mining operations much complicated and constrained. Essentially, the drilling and blasting are such sub-systems of mining that some disturbance and imbalance are unavoidable and caused whatever the known available technology is adopted.

To minimize the impact of blasting operations on the local environment and at the same time keeping production and productivity at par, a balanced approach is imperative.

The Central Mining Research Institute (CMRI), Dhanbad, has adopted a number of modified new approaches in this direction. There are also many significant futuristic planning options in the pipeline. It is hoped that in the coming years, blasting will be more environment friendly, economic and productive. CMRI is planning to establish its role by evolving new/modified methods to make the drilling and blasting sub-systems environmentally safe and efficient for sustained growth of the mining industry.

Recent Achievements

Compatible Drill Diameter and Bench Height — Efficiency and economy of a blasting sub-system are largely centered on the compatibility of drill diameter and bench height. A mismatched combination of the two creates an imbalance in the distribution of explosive charge weight within the hole which affects fragmentation, heave and other associated results. The drilling cost varies considerably with the variation of strength properties of rocks. CMRI has provided general guidelines for achieving the most compatible choice of drill diameter and bench height to achieve cost-effective drilling.

Other factors for selection of suitable diameter are geological condition, explosive type, capacity of shovel and nearness of the built-up areas. It is advisable to use small diameter holes particularly in environmentally sensitive areas. Also, the drill machines must be equipped with dust extractor.

Vibration Predictor Equation — CMRI has developed its own vibra-

tion predictor equation which takes into account the zone of disturbance created by blasting at a certain confidence level. The equation is quite simple and utilizes the concept of the energy decay of the blast-induced seismic wave propagated by geometrical spreading and inelastic attenuation. It is valid in the disturbed zone, i.e. $V > O$ and $Q > O$. The equation is:

$$V = n + K[D/Q^{0.5}]^{-1}$$

where V = Peak particle velocity (mm/s); D = Distance of the measuring transducer from the source (m); Q = Maximum charge per delay fired in a round of blast (kg); n relates to the category of parameters which are influenced by rock properties and geometrical discontinuities; K relates to design parameters including charge weight, distance from the source, charge diameter, burden, spacing, subdrilling, stemming length and delay interval.

This equation has been accepted both nationally and internationally and is being referred to for the determination of safe charge levels. It is likely to be used in many more mines in the near future.

Fragmentation Analyzing Scale — This scale evolved by CMRI can be used to predict qualitative assessment of fragmentation in any open-cast mine after determining the major joint sets and strike direction of bench faces and their corresponding angles. It can also be used in newly developed mines for the effective determination of the strike of bench faces so as to get good breakage when combined with conventional blasting practices. However, when the faces are already developed, this scale would help in determining the major parameters whose

modifications would lead to proper post-blast breakage.

New Spacing and Burden Formulae — In any blast geometry, burden and spacing are the most essential parameters. If the burden is very less, rock will be thrown to a considerable distance from the face, air blast level will be high and excessive fines will be produced. Too much burden will produce severe back break and shattering on the back wall. There are numerous empirical relationships suggested by different researchers for the estimation of the burden and spacing.

Based on the results of experimental blasts in nearly 70 mines, CMRI has developed new Burden and Spacing Formulae which incorporate blast design parameters, charge loading parameters and rock strength parameters including RQD (rock quality designation). These equations, have been found to be very effective for field use and applicable under varying rock geological conditions. One of these equations is:

$$B = H \times \frac{D_e}{D_h} \times \frac{5.93}{RQD} = 0.37 \sqrt{\frac{L}{C}}$$

where B = Burden (m); S = Spacing (m); H = Bench height (m); D_e = Diameter of explosive (mm); D_h = Diameter of blast hole (mm); RQD = Rock Quality Designation; L = Loading density (kg/m); C = Charge factor (kg/m³).

Wooden Spacers for Air-deck Blasting — Method of air-decking has become an increasingly popular technique in production and presplit blasting. The main aim of this technique is to control the breakage process through effective

distribution of explosive energy and thereby enhance the uniform rock breakage. Through 'air-deck' blasting, saving of explosives up to 30% has been claimed without sacrificing the quality of the blast.

To popularize this technique in Indian opencast mines, CMRI has developed an economical and easily operational method by designing wooden spacers of different specifications for different hole diameters. The spacers can be placed at any desired location inside a hole. The laboratory tests indicate that these spacers can safely withstand sufficient static and impulsive loads. The cost of such wooden spacers is also less in comparison to multiplug balloons and gasbags. Using wooden spacers and BOSTECH gasbags, CMRI has conducted various experiments at Chasnalla OCP, IISCO; Jambad OCP, ECL; Sasti OCP, WCL; Parej East OCP, CCL; Bermo mine, DVC; Panchpatmali bauxite mine, NALCO; Durgapur OCP, WCL and Dongri Buzurg mine, MOIL.

Ground Vibration, Human Response and Air Overpressure Standards — CMRI has established Vibration, Air Overpressure and Human Response Standards based on case studies in more than 80 Indian mines as given in the Tables 1-3. These standards are being referred to in various sponsored and consultancy projects. Instantel, Canada, has incorporated CMRI standards in Blast Mate Series III and Minimate Plus Compliance Software Module.

Segregation of Thin Coal Seam from Composite Overburden Blasting — CMRI has conducted experimental blasts to segregate thin coal seams up to 65% from composite

overburden blasting round. The technique envisages placement of explosive charge in a shothole judiciously with proper firing sequence so that differential horizontal movements help in the separation of coal from the main overburden muck pile. More experiments on the same line are in the process so as to establish the technique with concrete scientific base.

Table 1: Ground vibration threshold values at foundation level

Structure's Specification	Threshold value of PPV (mm/s)	
	≤24 Hz	>24 Hz
Domestic houses, construction structures with plasters, bridge	5	10
Industrial building, steel or reinforced concrete structures	12.5	25
Objects of historical importance, very sensitive structures, more than 50 years old construction and structures with poor state of repair	2	5

Table 2: Typical threshold sound level damaging values

Damage type	Values in dB
Structural damage	180
Plaster cracks	176
Loose window sash rattles	140-145
Failure of badly installed window panes	> 150
Failure of correctly installed window panes	> 168
Failure of all window panes	176

Table 3: Human response to particle velocity

Response	Particle velocity (mm/s)
Noticeable	0.5
Troublesome	5.0
Severe	15.0

Explosives for Hot Holes — CMRI scientists have developed heat resistant explosives (HRE) in collaboration with R&D Group of IBP. These explosives are in the process of field testing and subsequent approval of DGMS, Dhanbad, and will be marketed by the brand names 'Indoboost (HR)' and 'Indogel (HR)'. The thermal behaviour and characteristics of these explosives are:

Ignition temperature	: 310±5°C
Diameter	: 83, 125, 200 mm
Density	: 1.12±0.03 g/cc
VOD	: 3360 m/s [Indoboost (HR)] 3160 m/s [Indogel (HR)]
Shelf-life	: > 6 months at ambient temperature

Research is in progress to develop high strength small diameter permitted group of explosives for better pull in underground coal mines.

Control of Noise and Air-blast — CMRI, in recent years, has successfully implemented the non-electric initiation systems, viz. Raydet of M/s IDL and EXEL of M/s ICI, to reduce noise and air-blast produced by blasting. In the initial stage, CMRI scientists focused on various merits and demerits of these products to make them more efficient and accurate in order to get best output. These systems are now almost established in mining industry.

Experiments are also in progress on air-deck blasting using BOSTECH gasbags. Scientists are

trying to establish the theory of air-deck blasting in field conditions, using optical fibre wires, high speed video camera and a few other sophisticated instruments.

Software Packages — CMRI Nagpur Unit, in collaboration with a software company at Pune, has developed an image analyzer software package known as FRAGALYSIS for post blast fragmentation analysis. The package is quite user-friendly and has several options for different geological and rock characteristic parameters. Very shortly, it will be available in the market. CMRI has also developed an user-friendly graphics vibration analysis software namely 'VIBAN' which can be implemented on IBM Compatible PCs. 'DETBlast' software, developed by CMRI, relates to computer-aided blast design of tunnels.

Demolition Blasting — CMRI has undertaken a project at Howrah Municipal Corporation (HMC), West Bengal, for demolishing a number of abandoned water tanks in populated zones by blasting. After successful completion of the job, the technique will be extended to high-rise buildings and structures in cities and mining areas.

The institute has also undertaken two S&T projects sponsored by the Ministry of Coal, Government of India, in which the primary objectives are to establish the threshold values for the damage of underground roof and pillars owing to surface blasting in nearby opencast mines, and techno-economic assessment of drilling and blasting parameters for open cast mines. □

More Biomass and Achene from *Artemisia annua*

THE leaves and inflorescence of *Artemisia annua* L. (Asteraceae) plants produce a number of pharmaceutically and agriculturally important terpenoids, including artemisinin, an important antimalarial sesquiterpene lactone. Artemisinin, with its unique structure and activity, is effective against the drug-resistant strains of the malarial parasite *Plasmodium falciparum*. It also has potential as a herbicide. Many of the derivatives and related compounds of artemisinin are reported to have similar biological activities. Therefore, the economic production of artemisinin and related compounds has drawn worldwide attention.

In India, *A. annua* is cultivated in Kashmir valley. To meet the increasing demand of artemisinin, there is a need to extend its cultivation to other agroclimatic zones of India. An attempt has been made by the Central Institute of Medicinal Plants (CIMAP), Lucknow, to cultivate this plant in the sub-tropical climate of north Indian plains as a

winter season crop and to determine the most suitable planting time to enhance the yield of both biomass and achene. Different populations of *A. annua*, obtained by planting the seedlings at different times of the winter season, were found to differ significantly in their vegetative, flowering and fruit formation stages. A photoperiod between 11-13 h promoted rapid growth. The average 13.2 h photoperiod induced flowering under the day temperature below 40°C helped in achene formation. Plantations during October and November, were found good for both herb and achene production; the October sown plants produced more achenes, while the November sown plants, on account of their greater height, produced more herb mass. To obtain more herb mass and achene yield, it is thus recommended that in the sub-tropical climates like that of Lucknow, the crop of *A. annua* should be sown in the second half of September and transplanted in October, after one month. □

Betanin Determination in Beet Root using Modified TLC Densitometry

THE red coloured betacyanin (compound betanin) extracted from the beet root is used in dry mixes, sugar confectionery, ice cream industry and meat products. A number of methods for the estimation of betanin content in various materials, based on the use of colorimeter and HPLC, have been re-

ported in the literature. However, TLC densitometry is more often preferred for its simplicity, accuracy and low cost over HPLC method. A simple, accurate, rapid and inexpensive dual wavelength TLC - densitometry method for the betanin analysis in the beet root extracts has been developed at the Central Insti-

tute of Medicinal and Aromatic Plants (CIMAP), Lucknow. The apparatus consists of densitometer equipped with dual wave length thin layer chromatography scanner and data recorder Desaga model CD-50 along with precoated cellulose F plates (10 × 20 cm) with a layer thickness of 0.1 mm (Merck Germany).

The steps involved are: (i) preparation of a stock solution (3 mg/ml) in methanol-water (3:1) and loading different amounts of the dye on cellulose TLC plate; (ii) carrying out

chromatography in a glass TLC tank saturated with the mobile phase *tert*-butanol-acetic acid-water (40:10:20) developing plates at a height of about 15 cm; (iii) drying and scanning dye spots at 540 and 400 nm using dual wavelength mode with background subtraction and using a light spot of 1 × 2 nm.

A set of 15 extracts can be analyzed on a 20 × 20 cm cellulose plate in about 3 h. □

Dr Abdul Kalam visits CMRI

BHARAT RATNA Dr A.P.J. Abdul Kalam, Scientific Adviser to the Defence Minister and Secretary, Department of Defence Research & Development; and Director General, Defence Research and Development Organisation (DRDO), during a short visit to the Central Mining Research Institute

(CMRI), Dhanbad, on 28 March 1998, urged the scientists of the institute to strive hard to transform India into a 'developed country' from a 'developing country'.

He said, "In our first mission, we have achieved Independence. Now, our second mission should be to make India a developed country

and make it strong economically, scientifically and in defence".

According to him, India has a large potential for this, because it is highly rich in mineral resources, human resources and bio-diversity. What we need is strong determination and hard work. As the scientists are the important agents for change, they can play an important role in changing the face of the country by turning the wheels of progress.

Dr T.N. Singh, Director, CMRI, introduced Dr Kalam highlighting the unparalleled scientific achievements of this great scientist. He also presented a memento to Dr Kalam and also explained to him the main activities and achievements of the institute.

Dr Kalam laid the foundation stone of a Mine Fire Gallery which is to be set up to carry out realistic in-depth study on mine fire dynamics, and evolve and perfect fire control techniques for quick and economic way of solving the problems of fire in mines. Upon its completion the Gallery will be declared a National Facility for carrying out studies related to problems of mine fire, and effect of fire on ventilation and vice versa. It will also be helpful for testing the suitability of the materials used in underground mines, performance study of mine environment monitoring system and various other purposes.

Dr Kalam was also taken round some of the important laboratories of CMRI. □



Dr T.N. Singh explaining the activities of the 'Explosive Gallery' of CMRI to Dr A.P.J. Abdul Kalam

Meeting to Discuss ISO-certification for NAL

METALLURGICAL and Engineering Consultants (India) Ltd, [MECON], Ranchi, is likely to be the consultancy firm to help the National Aerospace Laboratories (NAL), Bangalore, in its ambitious plans for ISO certification. Shri P. Dutta, AGM (Tech.), MECON, Ranchi, visited some of the major facilities of NAL during 25-26 March 1998 and held a meeting with the Heads/Jt.Heads/Dy.Heads of Divisions/Units/Sections to chalk out a plan of action.

The NAL Director pointed out that his institute was moving into the 21st century with a number of tasks and projects where total quality management is of utmost importance. He said that ISO-9000 is an accepted framework for achieving this. Some of the CSIR labs like CFRI and CMERI have already obtained ISO certification while some others like NML were on their way to get this. VSSC is in the process of being certified in a very short time. He stressed that NAL will adopt a quality policy of its own and work aggressively towards obtaining ISO certification in the next 12 to 18 months.

Shri Dutta attended to queries regarding ISO-certification for NAL.

In response to a query whether the nature of work undertaken at NAL warrants 9001 certification or 9002, Shri Dutta explained that being an R&D laboratory, NAL would be certified as ISO 9001 for the simple reason that NAL designs most of the products it produces and rarely

borrow design or technologies from external agencies.

It is often the case that external organizations which borrow technologies developed by NAL go on to be ISO certified. Some members wanted to know if that was not proof enough of NAL's capabilities. Shri Dutta cleared the misconception saying that, the ISO certification was a proof of the efficiency of the procedures followed in an organization and has nothing to do with its products.

In response to a doubt expressed at the meeting that ISO 9000 yoke would choke the organization's productivity with its stringent documentation procedures, Shri Dutta drew attention to his own parent

organization MECON, which was ISO certified and whose productivity, he said, had increased substantially only after certification.

When asked about a conservative deadline before which certification could be achieved, Shri Dutta said that NAL could be certified to be of ISO-9001 standards in 12 months' time. He also made a small presentation on the major phases through which the organization would pass for successful implementation of the standards.

The NAL Director has now formed a committee under the Chairmanship of Dr B.R. Somashekar, Adv (Tech), to coordinate the ISO certification process from NAL's side. □

WORKSHOPS

International Workshop on Medicinal Plants — Their Bioactivity, Screening and Evaluation

THE Central Drug Research Institute (CDRI), Lucknow, recently hosted a four-day international workshop on 'Medicinal Plants — Their Bioactivity, Screening and Evaluation'. The workshop was organized by the NAM S&T Centre and cosponsored by UNIDO.

It was attended, in addition to several participants from India, by one representative each from Bangladesh, Bhutan, Cuba, Egypt, Malaysia, Nepal, Nigeria, Pakistan, Tanzania, Thailand and Vietnam, and two representatives from Sri Lanka. One expert from Australia, sponsored by WHO, also attended the workshop.

Dr R.A. Mashelkar, Director General, CSIR, inaugurated the workshop. Shri K.N. Johry, Director of the NAM Centre and Dr T. De Silva, Senior Technical Adviser of UNIDO, presented the genesis of the workshop and the role of bioactivity and evaluation of medicinal plants in the development of the drug industry.

Dr Mashelkar, in his inaugural address, pointed out that although the developing countries have rich tradition of indigenous system of medicine, efforts have been lacking for conservation, standardization and scientific evaluation of the medicinal plants resources. CSIR, he said, has initiated a coordinated project for the development and

commercialization of medicinal plants in India involving several laboratories of CSIR. CDRI has already developed a number of plant-based drugs. Some recent ones being 'Guglip', a hypolipidaemic drug, and 'Memory Plus', a memory enhancer, which are in the market. Another drug, 'Picroliv', a hepatoprotector, is at the clinical trials stage. Dr Mashelkar laid stress on the need to protect intellectual property relating to medicinal plants and drugs derived from them. He stated that turmeric is widely used in India since ancient times as a condiment and an anti-inflammatory agent, curcumin being its major active constituent. CDRI has found the activity of curcumin to be comparable to that of phenylbutazone in cases of rheumatoid arthritis without any side effects and with low ulcerogenic index. He recalled how CSIR successfully challenged the patent on healing properties of turmeric in the US Patent Office by an American scientist. He complimented the NAM Centre and UNIDO for organizing this important workshop in India at CDRI.

Dr C.M. Gupta, Director, CDRI, and Dr V.S. Ramamurthy, Secretary, Department of Science and Technology (DST) of the Government of India and Vice-President of the Governing Council of the Centre, who presided over the inaugural function, welcomed the participants and highlighted the importance of the workshop for developing countries.

Dr Satyawati, former Director-General of Indian Council of Medical Research (ICMR), who delivered the key-note address, referred to conventional methods of screening medicinal plants for biological activity and identifying the active principles through phyto-chemical stud-

ies, which have been in use in developing countries. There is a need, she said, to promote more and better organized inter-disciplinary studies on medicinal plants and their standardization and quality control for their therapeutic use.

In the plenary session, chaired by Dr De Silva, respective country reports were presented by Mr Md. Shahjahan (Bangladesh), Dr Maria Hortensia Fernandez de la Torre (Cuba), Dr Nahla Sayed Abdel Azim (Egypt), Dr B.N. Dhawan (India), Dr Rasadah Mat Ali (Malaysia), Dr Bharat P. Bashyal (Nepal), Dr (Mrs.) O.O. Adeyemi (Nigeria), Dr Qazi Najm-us-Saqib (Pakistan), Dr Gunaratne De Silva (Sri Lanka), Dr (Ms) Krishna Pootakhan (Thailand), Dr Mainen Julius Moshi (Tanzania) and Dr Pham Nim Man (Vietnam).

The workshop had seven technical sessions including 22 presentations dealing with biological screening and demonstration of techniques to assess bio-activity of medicinal plants. The topics covered included collection and authentication of medicinal plants, the chemical processing and organization of biological screening. Presentations on bio-activity covered: contraceptive, metabolic, hypolipidemic, anti-diabetic, anti-inflammatory, hepatoprotective, antiviral, anti-fungal, anti-bacterial, anti-protozoal and anti-helminthic activities. Presentations were made on immune system, adaptogens, regulatory toxicology, quality control and ethical aspect of animal experimentation. Presentations also covered intellectual property rights and their implications. Extended visits were arranged to various laboratories connected with screening of the bio-activity including endocrinology, medical mycology, microbiology, medicinal chemistry,

parasitology, toxicology and pharmacology. Visits were also made to the Herbarium, the Instrumentation Centre, and to the Central Institute of Medicinal & Aromatic Plants (CIMAP), where presentations were made on 'Domestication and conservation of medicinal plants'.

The faculty included two former Directors of CDRI, Dr B.N. Dhawan and Dr V.P. Kamboj; Dr R.C. Srimal, former Director, ITRC; Dr S.S. Handa, Director, Regional Research Laboratory (RRL), Jammu, and Dr Sushil Kumar, Director, CIMAP, apart from Dr B.N. Mehrotra, Dr M.P. Dubey, Dr H.K. Singh, Dr A.K. Rastogi, Dr Z.K. Khan, Dr G.P. Dutta, Dr J.C. Katiyar, Dr Sudhir Srivastava, Dr O.P. Asthana and D.K. Kulshreshtha, all from CDRI, Dr Roger W. Moni from Australia and Dr O.P. Gulati, Dr Sudhi Sinha, Dr S.A. Dahanukar, Dr K.R. Bhardwaj, Mr N.R. Subbaram and Dr Asha Mathur.

At the concluding session, Dr T. De Silva made a detailed presentation on UNIDO Programme on Industrial Utilization of Medicinal & Aromatic Plants for Developing Countries. Shri K.N. Johry offered the NAM Centre's support to follow up the recommendations of the workshop. Dr C.M. Gupta offered CDRI support in any programme related to this area which UNIDO or NAM Centre may wish to take up.

The recommendations which emerged during discussions are:

- Creation of a database of institutions in member countries where facilities and expertise are available for evaluation of bioactivity to facilitate exchange of material, scientists and placement for training.
- Member countries to undertake bioactivity evaluation of crude

drugs being exported by them to develop value-added products.

- Need for setting up the bioactive screening facilities by member countries for their flora, in particular for endemic and threatened species.
- Assistance from international organizations like UNIDO for setting up the facilities, and from UNIDO and NAM S&T Centre for training placement, etc.
- Creation of awareness by member countries on procedures for get-

ting patent protection natively as well as abroad.

Dr Nitya Anand, former Director, CDRI, and Consultant to UNIDO, distributed certificates to the participants and delivered the valedictory address.

On behalf of the participants, Ms Krishna Pootakhan thanked UNIDO, NAM S&T Centre, Director CDRI, Dr Kulshrestha (Co-ordinator of the workshop) and his team for the excellent arrangements made for the workshop. □

varies towards various individuals. Moreover, factors like genetic make up of the individual, disease and malnutrition also play a role in determining the toxic effects of a chemical. Dr P.N. Viswanathan, Dy. Director, ITRC, talked about the biomonitoring of chemicals that is being done since the time of Aristotle and Pythagoras and that modern techniques are being utilized for the development of more specific biomarkers. Dr Poonam Kakkar, Organizing Secretary, proposed a vote of thanks and provided details of programme of the workshop.

Workshop on Biological Monitoring of Chemical Exposure

A workshop on 'Biological Monitoring of Chemical Exposure', sponsored by the Section on Toxicology, International Union of Pharmacology, International Council of Scientific Unions, Council of Scientific & Industrial Research, New Delhi and cosponsored by Council of Science and Technology, U.P., was recently organized at the Industrial Toxicology Research Centre (ITRC), Lucknow. In all 24 participants attended, 19 from India, two from Hungary and one each from Sri Lanka, Pakistan and Iran. The foreign participants were sponsored by International Council of Scientific Unions. The workshop comprised lead lectures by experts, panel discussions, practical demonstrations and a field trip.

Dr P.S. Chauhan, Head, Cell Biology Unit, Bhabha Atomic Research Centre, Trombay, while inaugurating the workshop, elaborated on the needs and prospects of toxicological evaluations, biological monitoring and biomarkers. He emphasized on the need for

development of new methods at molecular level with the help of latest instruments capable of recording minutest changes in the cell environment. He also proposed a national programme on biological monitoring in which ITRC should take a lead role by being the nodal centre.

Earlier, welcoming the participants, Dr P.K. Seth, Director, ITRC, talked about the genesis of the workshop and stressed the need for biomarkers. He elaborated on the advances made in the development of biomarkers which are both cause and effect related. The need for identifying peripheral markers for neurotoxicological disorders was also highlighted. Referring to his study of blood platelets in schizophrenia patients, he suggested that blood platelets are good peripheral markers for neurological symptoms.

Dr R.C. Srimal while presiding over the function said that data on the safety of a large number of chemicals are already available. The response to these chemicals

In the seven sessions held during the six-day workshop, different aspects of biological monitoring of chemical exposure were discussed which accentuated the chemical and epidemiological studies on pesticides and industrial chemicals. Lectures by eminent scientists and medical professionals presented case studies of chemical exposure. For biomarkers of neurological diseases, blood platelets were found to be a good peripheral marker. The possibility of recording the receptor protein changes at the m-RNA level were also discussed. It was observed that inter individual variations in susceptibility to drugs/chemicals and polymorphic variation in ethnic groups and geographically diverse societies are the factors deciding the susceptible population. Role of nutritional factors in the modulation of toxicity of chemicals with special reference to pharmacokinetics and biotransformation to xenobiotics was discussed in detail. A need was felt for development of more specific molecular probes for risk assessment so that an early detection of the exposure to chemicals may be made leading to preventive strategies. The participants were also trained to analyze actual exposure situations and detect the source of



Sitting on dais during 'Biological Monitoring of Chemical Exposure' (from left) are: Dr P.N. Viswanathan, Dr P.K. Seth, Dr R.C. Simal, Dr P.S. Chauhan, and Dr Poonam Kakkar (top) and visit of ITRC laboratory (above)

The techniques demonstrated to the participants during the workshop include : (i) assay of neurotransmitter receptors, (ii) assay of DNA adducts, (iii) Ames test, (iv) analysis of organochlorine pesticides, (v) metal analysis in environmental and biological samples, (vi) enzyme-linked immunosorbent assay for detection of pesticide residues in food items, and (vii) comet assay.

At the valedictory function, Dr S.C. Rai, Mayor of Lucknow and Chief Guest on the occasion, stressed the need for greater collaboration and cooperation in scientific research. Prof. D.P. Agarwal from Hamburg delivered the valedictory lecture on 'Adverse reactions to industrial chemicals and xenobiotics, screening of low and high risk population using genetic markers'. In his lecture he elaborated on multiple, simultaneously recurring interactions between genes and environment and the subsequent phenotypic expression of heritable characters.

Following recommendations were made during the workshop:

- There is an urgent need for designing and developing specific molecular probes to detect earliest and minutest events in the toxicity of occupational and environmental chemicals.

- It is desirable to develop *in vitro* and *in vivo* assay for toxicity using state of the art molecular toxicology approaches.

- Efforts should be made to validate such molecular probes in field conditions through molecular epidemiology especially in situations where endemic build-up of toxic risk are suspected.

exposure. Several clinical studies related to pesticide, solvent, MIC and metal exposure were also presented. The possible routes of exposure including air, water and food and ITRC's contribution in detecting such exposures were discussed. Apart from these, newer techniques used in the risk assessment and molecular epidemiology were demonstrated to the participants. A visit to

the local factory was arranged where actual working conditions were shown to the participants and the health monitoring of workers was also demonstrated.

Two group discussions were held on biological monitoring for chemical risk assessment and need for specific probes in molecular epidemiology.

- The young workers in developing countries should be provided opportunities to pursue research in this area through short visits to established laboratories.

- Such training programme should be organized at more frequent intervals and for longer duration.

- Training centres on regional basis should be identified for training the young workers in this area. ITRC could serve as one of the Regional Centres.

The proceedings of the workshop have been published in a document titled *Biological Monitoring of Chemical Exposure*. □

Workshop on Utilization of Fly Ash

THE Polytechnology Transfer Centre (PTC), Bhopal; Satpura Thermal Power Station; and Directorate of Industries (Government of M.P.), organized a workshop on 'Utilization of Fly Ash' on 9 March 1998 at Sarni. The workshop was attended by about 150 delegates.

The workshop was inaugurated by Dr Sandeep Khanna, IAS, Principal Secretary, Commerce & Industry, and presided over by Shri Ryne, Executive Director, Satpura Thermal Power Station.

In his address, Shri Khanna stressed the need for utilization of fly ash to reduce pollution. Shri Ryne in his presidential address assured all possible help to entrepreneurs for setting up fly ash-based projects in Sarni near the Thermal Power Station.

Shri M.S. Viridi, Project Officer, PTC Bhopal, delivered keynote address on utilization of fly ash, giving detailed account of R&D work done by CSIR laboratories and expressed his eagerness to help the entrepreneurs to set up projects like

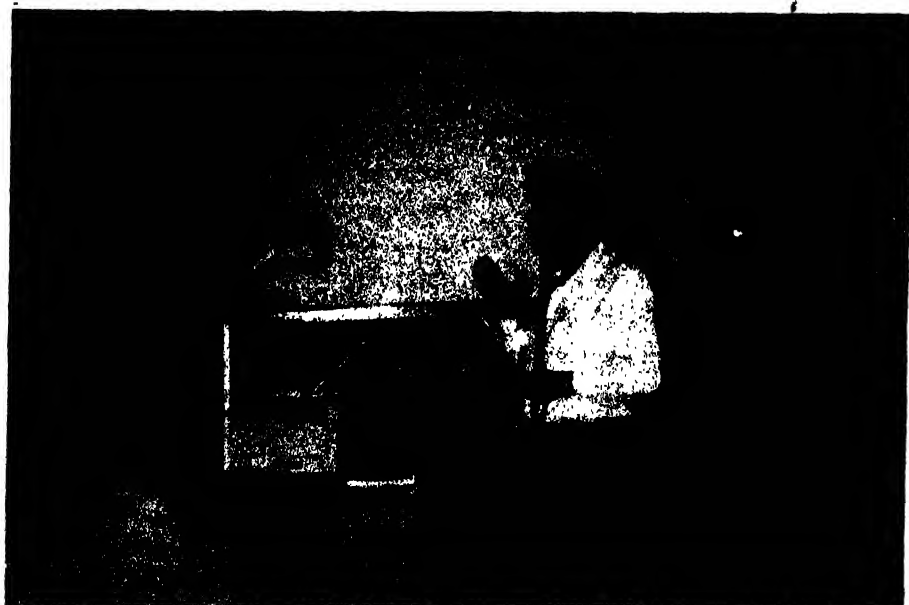
fly ash-sand-lime building bricks, fly ash aggregate, etc. Dr Mohini Saxena spoke on fly ash utilization for waste land development and fly ash-based paints, etc. In addition, lectures were delivered by experts from Western Coal Field, consultants from Nagpur, etc. □

Rural Pottery — New Frontiers

THE Central Glass & Ceramic Research Institute's Naroda Centre has developed an appropriate technology package on Improvement in Productivity and Quality of Rural Pottery in Sabarkantha and Kheda Districts of Gujarat under the joint financial sponsorship of the Department of Science & Technology (DST), Rural Technology Institute, Gujarat, (RTIG) and CSIR. The technology package has been transferred to RTIG, and subsequently to the rural potters.

RTIG organized a one-day workshop on 'Rural Pottery — New Frontiers' at its demonstration centre at Wankaner village, Bhiloda taluka in Sabarkantha district, on 23 April 1998. About 100 participants from 23 villages of Gujarat attended the workshop. Shri I.B. Joshi, Member Secretary, Gujarat Matikam Kalakari Board, Gandhinagar, was the Chief Guest.

Shri R.D. Vaidya, General Manager, welcomed the gathering. Shri R..M. Patel, Senior Manager (R&D), RTIG, presented a paper on the experience of RTIG with particular emphasis on rural pottery. Dr K.N.



Shri M.S. Viridi delivering the keynote address during the workshop on 'Utilization of Fly Ash'



such a project and achieved a breakthrough. He explained the methodology adopted by the centre to select the villages for improvement in the quality of existing rural pottery in Sabarkantha and Kheda districts. He also pointed out that the range of products in these districts was limited to pots, bowls, earthen oil lamps, hundies and tavdis. The improvement of quality and productivity was based on the five technology elements, namely: Optimization of body mixes; Improvement in processing of raw materials and preparation of body mixes; Improved equipment for preparation of body mixes; Improved equipment for fabrication of articles, and Energy efficient firing systems.

In order to get the benefits of globalization and survive the competition, the rural potters perforce should diversify their existing product range into clay flooring tiles, black pottery and also glazed terracotta products, he said.

Shri R.M. Savsani, T.O., CGCRI Naroda Centre, narrated the findings of CGCRI in the form of a technical paper entitled Improvement in Productivity and Quality of Existing Rural Pottery. He explained that different body mixes had been prepared in different proportions and their properties, viz. water of plasticity, Atterberg Number, dry shrinkage and unfired strength (modulus of rupture) studied. Based on the results of evaluation, optimized body mixes were identified and implemented in target villages. The feed-back on the introduction of improved body mixes has shown



Shri I.B.Joshi inaugurating the workshop on 'Rural Pottery—New Frontiers'. Others seen in the photo (from left) are: Shri R.M.Patel, Shri Natabhai Raval, Dr K.N.Maiti, Shri R.D.Vaidya, Shri Modi, and Shri V.B. Sevak, and a view of the participants

Maiti, Scientist-in-Charge, CGCRI Naroda Centre, presented a paper on 'Problems and Prospects of Rural Pottery', elaborating on the need to look into the appropriateness of the composition of body mixes conceived by earlier potters in view of the changes that have taken place in the type and quality of common clays with the passage of time. He further dealt with the changes taking place in the quality of pond clays

used by the rural potters owing to floods, etc. According to him, although a great deal of work has been carried out and a large number of projects have been initiated by various agencies for the development of rural pottery, nobody has ever paid any attention to auditing and scrutinizing the present body mixes of rural potters for their appropriateness. The Naroda Centre has for the first time initiated action on

that in addition to the reduction in the dry and fired rejections, the productivity as well as the quality of products has improved significantly.

Shri B.B. Machhoya, T.O., CGCRI Naroda Centre, presented a paper on Development of High Strength Black Pottery and Kabiz. The rural potters of Nizamabad and Lucknow in U.P. are famous for their black pottery owing to application of Kabiz. Elsewhere, the efforts to produce black pottery had proved unsuccessful. The Naroda Centre had successfully developed, for the first time, Kabiz from the common clays of Gujarat. Some common clays available in Morbi in Rajkot district and some places in Sabarkantha and Kheda districts have been found suitable for the preparation of Kabiz. The process of preparing Kabiz from common clays was outlined lucidly. The application of Kabiz on the wares as well as the firing techniques for the production of black pottery were explained to the participants. The designing and the construction of an improved kiln for the production of high strength black pottery were also discussed.

Shri R.B.V. Subramanian, Scientist, CGCRI Naroda Centre, presented a paper on Efficient Firing Systems for Rural Pottery. The paper dealt with the necessity for efficient firing as well as drawbacks of the traditional clamp kilns used at present by the rural potters. The necessity to introduce energy efficient rural kilns was emphasized. Two improved kilns, viz. pit type

updraught kiln and bottle type updraught kiln were discussed along with the specification of construction materials, construction details as well as their firing operations.

The participating rural potters were provided with a first hand experience on the various processing and fabrication techniques by a live demonstration at RTI, Wankaner. Production of black pottery, firing in improved updraught bottle kiln and pit type updraught kiln were also demonstrated to the rural potters present there.

During the discussions, Shri Natabhai Raval, Technical Officer, Gujarat Khadi Gramodyog Board, advised the potters to take advantage of the technical knowledge and expertise available at CGCRI Naroda Centre, and to participate in large numbers in the training programmes conducted by RTI. He requested the potters to disseminate the information acquired by them during the workshop to their fellow potters who could not attend the workshop.

Shri I.B. Joshi, Member Secretary, MatiKam Board, explained the activities of the Board and assured the potters that the Board will work wholeheartedly towards the upliftment of rural potters.

Shri Bikhabhai Nathabhai Prajapati of Kaniyol village, one of the potters who had implemented the optimized body mix

in their trade, said that his production had increased by about 25%, and both the unfired and fired losses had reduced considerably. He pleaded with the other potters to take advantage of the technical knowledge of CGCRI and the facilities available at RTI.

Shri Chimanbhai Bijalbhai Prajapati of Mulsan Village in Mehsana district narrated his experience regarding the production of rural pottery using the common clays available in his village. His efforts to reduce the firing losses by introducing Vadali black clay were not successful owing to the stiff resistance of Vadali potters regarding procurement of the clay. He appreciated the efforts made by the RTI and CGCRI to create awareness among the rural potters regarding the diversified products as well as improving the productivity and the quality of the existing products.

Shri Sanjay Prajapati of Kandli village in Kheda district, who was a trainee in one of the earlier pottery training programmes held at CGCRI, Naroda Centre, said that he had been immensely benefited by the training imparted to him and could now make his living by the production of artistic wares and decorated type planters which have an assured market in the region.

Shri Modi, Senior Manager, RTIG, proposed a vote of thanks. □

TRAINING PROGRAMMES

Writing a Scientific Paper

THE National Institute of Science Communication (NISCOM), New Delhi, organized seventh training programme on 'Writing a Scientific Paper' during 18-20 March 1998. Sixteen young research workers from universities and CSIR laboratories participated in this training programme. The programme was inaugurated by Shri S.K. Nag, Coordinator, Popular Science Division, NISCOM, who in his address underlined the need for such training programmes for young research workers who are at the threshold of their carrier. He said that NISCOM, which publishes several research journals, popular science journals, and books on different aspects of science, has developed a skill and infrastructure to organize such training programmes. The expertise and facilities available at NISCOM are put to appropriate use by imparting such training to young scientists who are also prospective authors for publishing their research findings in the journals published by NISCOM. Dr S.A.I.

Rizvi, Coordinator, Periodicals Division, NISCOM, also addressed the gathering at the inaugural function. He pointed out that while such training programmes help the authors prepare their manuscripts in a better way, these also help the editors as they receive the better manuscripts for their journals.

The topics covered during this training programme were: Elements of a Research Paper (Dr Gian Singh); Presentation of S&T Results and Interpretation (Shri Ashok Sen); Patents (Shri M.M.S. Karki); Poster and Oral Presentation (Dr T.K. Mukherjee); Evaluation of a Scientific Paper, Peer Review & Ethics (Dr R.S. Beniwal); Proof Reading & Printing (Shri Rajiv Mathur); Characteristics and Common Faults in S&T Writing (Dr B.C. Sharma); Reviews and Their Significance (Smt. S.P. Mehta); and Citation Analysis (Shri K.C. Garg). The preparation of manuscript on the floppy was also the topic of discussion during one of the sessions.

This faculty members are experienced editors of various science journals being published by NISCOM (Shri Garg is a Scientist in NISTADS). Practical suggestions for preparation of good manuscripts were also given by the speakers.

The participants were taken round the facilities available at NISCOM. They were acquainted with various stages through which a manuscript passes during its flow from manuscript stage to the printed version in a research journal.

In the valedictory session the participants expressed their views about the usefulness of the training programme. The feedback from the participants indicated that the programme was well received and appreciated. Shri S.K. Nag distributed the certificates to the participants. □

Training-cum-Demonstration Programmes in Ceramics

AS a part of Human Resource Development Programme for ceramic industry, with special emphasis on small-scale sector, the Central Glass & Ceramic Research Institute's Naroda Centre, has been conducting a series of Training-cum-Demonstration (T&D) programmes as well as short term/capsule courses on topics ranging from raw materials to finished products.

The different T&D programmes conducted during the year 1997-98 are: chemical testing of ceramic raw materials; physical testing of ceramic and refractory raw materials and products; production of bone china and novelty wares; production of acid-resistant bricks and tiles; production of wall tiles; making of matt glazes for crockery & table-



Shri S.K. Nag delivering the inaugural address during the workshop on 'Writing a Scientific Paper'

wares and production of glazed roofing tiles. The duration of these programmes ranged from 5 to 10 days. The total number of participants from industry and the total revenue earned for all these T&D programmes were 39 and Rs 0.163 million respectively.

The programme on physical testing consisted of testing procedures relevant for testing of various raw materials and products as per standards and their relevance for setting up a small laboratory. The programme on chemical testing dwelt upon the analysis of various constituents of ceramic raw materials, finished products, frits and glazes. All the other programmes were aimed at the transfer of technology and comprised: theoretical lectures and practical demonstrations covering the recent advances in the production of respective ceramic products; availability, function and specification of raw materials; compounding and preparation of ceramic bodies and their makings; properties of plaster of Paris and designing of moulds; different methods of forming ceramic wares; compounding and manufacture of frits & glazes; ceramic kilns and their operation; biscuit, glost and decoration firings; kiln furniture, defects in products and their remedies; testing and quality control of raw materials and ceramic products as well as process control measures in the production of traditional ceramics. The exhaustive and elaborate technological documents for the respective technologies were also provided to the participants.

The Small Industries Service Institute under the Development Commissioner, Small Scale Industries, Ministry of Industries, participated in the programmes aimed at the transfer the technology to the entrepreneurs in small scale sector.

Six short-term/capsule courses on raw materials and ceramic unit processes were also conducted during 1997-98. The duration of these programmes was 1-2 days. The total number of participants from the ceramic industry and the total revenue earned were 121 and Rs 60,500 respectively. The topics covered under these capsule courses were: ceramic raw materials; ceramic firing and firing schedules; processing

and grinding of non-plastic raw materials; different types of ceramic bodies; medium temp. (1200°-1280° C) ceramic glazes and defects and remedies in the ceramic bodies & glazes. The exhaustive and elaborate technological documents were also provided to the participants.

Although these capsule courses were meant for small-scale sector, the organized sector was also benefited from the courses. □

NAL-UNI LECTURE SERIES

Course on Software Engineering

THE eleventh course under the NAL-UNI Lecture Series 'Software Engineering for Mission/Safety-Critical Systems' was conducted on 18-20 March 1998 at the T.S. Seminar Hall of the National Aerospace Laboratories (NAL), Bangalore. It had 26 participants from R&D establishments (ADA, BARC, C-DOT, ISAC, VSSC, NRSA, LRDE, DRDL, CABS and ITR) and industry (Daimler Benz, Calyx Software). The faculty for this three-day course included: A. Pedar (Course Coordinator) and J. Jayanthi (NAL), K. Karunakar (ADA), Y.N. Srikant and V.V.S. Sarma (IISc), Vijay Rao (CASSA) and Kanchana Gopinath (CABS).

Welcoming the participants, the NAL Director Dr T.S. Prahlaḍ talked about the pivotal role played by software in aerospace programmes. Recalling that we are currently undertaking aerospace projects worth about Rs 50,000 million in India whose fate will, to a considerable measure, be decided by the quality of software which goes into these programmes, Dr Prahlaḍ said, "Many debates and discussions at ADA on software show that there is no real foolproof method for fully certifying software. Some elements

of risk analysis are always involved". Dr Prahlaḍ expressed the hope that during the NAL-UNI course, Dr Pedar and his colleagues will throw more light on the methodologies involved to make software as safe as possible.

Dr Pedar opened the lecture series by giving a masterly overview of software engineering. "Software", he explained, "plays a dual role: it is both a product and a vehicle to deliver other products". In his brief historical review of software which he also defined as a transformer of information, Dr Pedar recalled the days (up to 1970 or so) when program writing was thought more to be an art, with accolades being reserved for the programmer who reduced a 200-line program to 100 lines. "We have come a long way since then", he said, "and it is not unusual to encounter a program with a million lines of code today".

Dr Pedar also discussed issues involved in software management, software process models and talked about the constantly increasing demands on the software engineers. "We demand failure rates of 10^{-9} for civil aircraft and 10^{-7} for military air-

craft. There is widening scope of software solutions (from medical instruments to railway signaling systems) and the associated responsibilities. We can't have medical instruments which kill people. The only way out is to adopt a disciplined engineering approach to software development", said Dr Pedar. □

HONOURS & AWARDS

Dr Pijush K. Das

DR Pijush K. Das, Head, Department of Molecular Cell Biology, Indian Institute of Chemical Biology (IICB), Calcutta, has been elected fellow of the National Academy of Sciences (FNASc).



Dr Das has had a brilliant academic record. He was 1st class 2nd in M.Sc. (Biochemistry) of Calcutta University. After completing his Ph.D. in Biochemistry from Calcutta University in 1979, he worked with Prof. B.K. Bacchawat on liposomal drug delivery till 1982 and then proceeded to NIH, USA, where he made significant contributions to enzyme replacement therapy in lysosomal storage diseases. He set

up his own laboratory in 1987 at IICB and made original contributions to the area of cell biology. One of the most outstanding contributions of Dr Das is the development of a new drug targeting method for the chemotherapy of visceral leishmaniasis, a dreaded parasitic disease in India, with almost total reduction of side effects. Since the method is based on one of the macrophage recycling receptors, it has the potential of horizontal access to other macrophage-associated diseases. Dr Das was one of the members of the pioneering group in India to show the selective targeting of liposomal entrapped material to various liver cells. His recent work on extracellular matrix (ECM) binding proteins involving the role of adhesion proteins in gliding the parasite through the ECM network may open up new horizons in parasite biology.

Dr Das is a member of Guha Research Conference and Molecu-

lar Immunology Forum and Fellow of the West Bengal Academy of Science and Technology (FAScT).

Dr L.K. Aggarwal

DR L.K. Aggarwal, Scientist, Central Building Research Institute (CBRI), Roorkee, has been awarded the Corrosion Awareness Promotion Award, 1996-97 by NACE International India Section, for his outstanding contribution to the field of Corrosion Protection to Concrete & Rebar and Paint formulations. The award is given to an individual who is working in the field of corrosion with excellent research contribution to corrosion evaluation, prevention, management, application and promotion. The award carries a plaque and Rs 10,000 in cash.

The award was presented by Dr R.B. Puyear, President, NACE International, Houston, USA, at the International Conference & Exhibition on Corrosion held in Mumbai. □



Dr L.K. Aggarwal receiving the 'Corrosion Awareness Promotion Award' 1996-97, from Dr R.B. Puyear, President, NACE

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CSIR NEWS

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IICT signs agreement with CytoMed, USA, for development of process technology for new drugs

THE Indian Institute of Chemical Technology (IICT), Hyderabad, has recently signed a contract research agreement with CytoMed Corporation Inc., USA, for \$ 75,000. Signed by Mr Thomas Beck, President and Chief Executive Officer, CytoMed and Dr K.V. Raghavan, Director, IICT, in the presence of Dr R.A. Mashelkar, Director General, CSIR, in New Delhi, the agreement envisages the development of an improved process to produce more efficiently one of the CytoMed's proprietary compounds and also to synthesize chiral enantiomers of two other proprietary compounds. The two compounds are undergoing clinical trials for their anti-inflammatory, -allergic and -gastrointestinal activities.

This is the second agreement the company has signed with IICT, and is the result of the success achieved by IICT in the first agreement on development of novel process chemistry and route for an anti-asthma drug. The IICT process has been rated by CytoMed to be

eco-friendly, cost-effective and internationally patentable.

Speaking on the occasion, Dr Beck said that he was very pleased with the excellent chemistry done in the given time frame by the institute under the earlier agreement, which had resulted in negotiating the sec-

ond agreement. He also visited IICT and presented mementoes to the members of the IICT project team after commending their performance.

CytoMed is a biotech company promoted by private money and venture capital funds. It specializes



Dr K.V. Raghavan, Director, IICT and Mr Thomas Beck, President and CEO, CytoMed, exchanging the agreement documents in the presence of Dr R.A. Mashelkar, Director General, CSIR

in development of new drug molecules and converting them into marketable products. It sources a large part of its R&D work from outside research agencies. The earlier agreement with IICT was its

first exposure to India. Enthused by the success, the company is increasing out sourcing its chemical process work from India as the quality of the work here is of high order and patentable. □

R&D Activities at NIO

THE major R&D activities at the National Institute of Oceanography (NIO), Goa, in the recent past, include:

Turnkey Project for National Thermal Power Corporation

The work on this single largest sponsored project for Rs 19.3 million for the National Thermal Power Corporation (NTPC), New Delhi, involves initial assessment of environment and identifying suitable locations for intake of seawater and discharge of thermal effluents for its thermal power plant proposed near Simhadri, Visakhapatnam (Andhra Pradesh). The institute in collaboration with HR Wallingford, an engineering consultancy firm from United Kingdom, will also review the cooling water system layout, technical specifications and design details.

Gas Hydrate Resources Map of India

The Gas Authority of India Limited (GAIL) has asked NIO to prepare a Gas Hydrate Resources Map of India as a part of the National Gas Hydrate Programme (NGHP). The results were presented before consulting US geoscientists at a meeting in New Delhi. The quality of the work done and the capabilities of the institute were greatly appreciated by US and GAIL geoscientists. This bodes well for future funding in gas hydrates surveys, the national

funding of which has been pegged at Rs 400 million for the 9th Plan.

The Legal Continental Shelf of India

The Department of Ocean Development (DOD) is leading a national endeavor to delineate the outer limits of the Legal Continental Shelf (LCS) of India to fulfill the requirements of the United Nations Conference on Law of the Sea (UNCLOS). NIO has been identified as the lead agency for various activities of this project. It has prepared a document outlining the plan of action to be adopted by India for this task. The institute's efforts in this endeavor have been appreciated by the Secretary, DOD. The funding outlay for the LCS work is of the order of Rs 200-300 million.

EIA studies

A multidisciplinary cruise was undertaken by NIO, on-board the Russian research vessel 'Yuzmorgeologiya' to the Central Indian Ocean Basin during which a red tide *Trichodesmium* (cyanobacterium) bloom was spotted off Karwar indicating low nitrate content in the waters.

Various species of benthic animals beyond 5500 m depth were photographed, as were faecal pellets (spiral/heaped coils) of deposit feeders belonging to in- and epifauna of deep-sea sediments. □

PC-based Data Acquisition system for Thermophysical Studies

THE PC-based data acquisition system for thermophysical studies, developed by the Materials Science Division of the National Aerospace Laboratories (NAL), Bangalore, has been successfully installed during 19-20 March 1998 at the Inter University Consortium, Indore. This is the third installation of such system. Earlier systems have been installed at Raman Research Institute, where the system is essentially used for liquid crystal studies, and the University of Mysore, where the system is being used for phase transition studies.

The system, built around a temperature-controlled furnace with attachments for studying several thermophysical phenomena, is available both in the PC-based and manual modes. The PC-based system offers software control of temperature, temperature gradient and the computation of different physical activities.

Some of the typical applications of the system are: AC resistivity, absolute thermoelectric power, AC specific heat, differential thermal analysis, dielectric constant and thermal expansion. The temperature range supported is 25-1000°C, the rate of heating varies from 1°C/min. to 10°C/min. and the temperature stability is $\pm 0.1^\circ\text{C}$.

All the three systems involved customized development catering to specific requirements of the R&D establishments. The highlight of the system is its high accuracy, control and stability. According to Drs T.G. Ramesh and V. Shubha, who led

the system-development team, users required to make very precise measurements are most likely to need

such a system, and R&D labs are to constitute the bulk of the market segment. □

Leaf:Stem Ratio as Morphological Indicator of Menthol Mint Crop Maturity

THE essential oil in menthol mint plant is largely present in the leaves. It is synthesized and stored in the trichomes born on the epidermal cell layers. A plant bearing relatively more leaves normally contains higher amount of essential oil. As mint plant grows, axillary buds give rise to secondary, tertiary and higher order of branches, thereby increasing the shoot mass. The leaf:stem ratio in a plant is a measure of leafy component of the total shoot mass. Its estimation depends upon the size, number and weight of leaves, and internodal distances, thickness and density of the stem. It varies as a plant matures. Similarly, the magnitude of the leaf:stem ratio is different for the crop developing from planted/transplanted propagules from the one obtainable from regenerated plants from the ratoons of first harvest.

Studies were conducted at the Central Institute of Medicinal and Aromatic Plants (CIMAP), Lucknow, for the possible use of leaf:stem ratio as a morphological indicator of crop maturity under diverse environmental conditions, for a minimal assured yield of essential oil from menthol mint crop. Such morphological markers are not yet available for mints whose shoots are a source of an essential oil, extensively used in food, pharmaceutical and cosmetic industries.

The cultivars of menthol-mint selected for the study were: the dwarf variety Kalka (Hy-77) and the tall varieties Gomti (MAH-9), Hariti (SS-1-4), Himalaya (MAS-92-1) and Shivalik. Experiments were carried

out on the sucker planted and seedling transplanted menthol mint crops. Only those experiments in which the herb yield was at least 0.5 kg/m² were considered for the prediction.

In the first harvest, the leaf:stem ratio which corresponded to the highest essential oil yields for both planted and transplanted crops of cv Kalka was around 1.3. Among the taller varieties, the leaf:stem ratios for high essential oil yields were about 0.8 for cv Hariti, 0.9 for cv Gomti, and 1.0 for cv Shivalik and Himalaya. Similarly, the optimum leaf:stem ratios for essential oil yields from second harvest were about 1.0 for cv Gomti, 1.1 for cv Shivalik, 1.2 for cv Hariti, 1.4 for cv Kalka and 1.5 for cv Himalaya. Such a criterion, if used judiciously, would benefit growers of mint crops, specially in the Tarai region of Uttar Pradesh. □

HAL Autoclave

DR T.S. Prahlad, Director, National Aerospace Laboratories (NAL), Bangalore, along with some of his NAL colleagues, recently visited BHEL, Trichy, and formally flagged off the computer-controlled 4m × 8m autoclave which NAL has delivered to HAL in partnership with BHEL. The new autoclave vessel is a fine piece of engineering. The pressure vessel can attain a pressure of 10 bar and a temperature of 300°C.

The passage of the 116,639 kg pressure vessel from Trichy to Banga-

lore itself proved to be quite an adventure. Before the autoclave began its journey a reconnaissance trip had to be made, to chart out the path which the autoclave would traverse, especially to ensure that there are no weak road bridges en route. The physical size of the autoclave is 12.5 m × 5.6m. □

Extended Hot Air Oven at FRP Pilot Plant

AT a brief function on 3 April 1998, Dr T.S. Prahlad, Director, National Aerospace Laboratories (NAL), Bangalore, formally inaugurated the extended hot air oven at the FRP Pilot Plant. The 2683 cu ft oven can attain a temperature of 85°C with a heating rate of 2°C per minute. The size has been chosen to accommodate through wings of a 12m span.

The most remarkable aspect of this project, undertaken jointly by the FRP Pilot Plant, Electrical Section and Aerospace Electronics and Systems Division, was the speed with which it was executed. Work started on 23 February 1998 and the oven was ready on 25 March 1998. □

High Yielding Genotype of Vetiver

IN a pilot scale trial, recently conducted with five elite strains of vetiver (*Vetiveria zizanioides*) at the Central Institute of Medicinal and Aromatic Plants (CIMAP), Lucknow, the genotype BDP-1 was found to be the most promising strain. These genotypes were being screened from 45 indigenous and exotic germplasm accessions collected and field tested against local

cultivars KS-1 and Sugandha way back since 1989-90. Both these cultivars, viz. KS-1 and Sugandha, were developed by CIMAP a decade ago.

Genotype BDP-1, the most promising one, yielded over 90% more dry root and 155% more oil. It contained about 30% more oil in

the roots in comparison to check KS-1. The genotype BDP-1 has longer (6.8 cm) and thicker (4.5 mm) roots of record magnitude, a property suitable for better moisture absorption and soil conservation. This genotype is soon to be released as commercial cultivar. □

Methane Emission Studies in Coal Mines and Resource Potential Evaluation for CBM Production

EMISSION of methane has been a continual source of safety and production problems ever since the beginning of underground coal mining. Several major coal mining accidents in various coal mines have taken place in India since the beginning of this century, owing to explosion of firedamp. These accidents happened because of poor environmental management, particularly that of firedamp, which had promising fuel value. With growing demand of coal in India's energy programme and fast depletion of shallower deposits in the country, the underground mining of coal will be concentrated in deeper gassy seams, which would further aggravate the gas hazard potential. It is therefore essential to have regular check on general body firedamp concentration to detect presence of methane in any underground coal mine.

In recent years, methane has also been identified as a potent greenhouse gas with a radiative forcing potential of 30 to 55 times that of carbon dioxide. Increasing atmospheric concentrations of methane will have important implications for global climate. Coal mining, particularly from underground mines, contributes to the in-

creasing abundance of atmospheric methane. The estimates of methane emission to the atmosphere from coal mining activities in India have been found to increase from 0.06 to 0.40 mt between the years 1951 and 1991 and may further rise to 1.0 mt by 2010 AD.

Methane is removed from underground mines as a safety measure but there is also interest in it as a source of fuel, particularly to the coalbed methane (CBM) industry. Commercial production of coalbed methane is now a reality but this industry in India lags behind primarily owing to the knowledge gap of its resource potential.

The Central Mining Research Institute (CMRI), Dhanbad, has developed facilities for gas desorption studies and has been providing technical and scientific assistance to the industry for investigation on methane emission, advice on gassiness, associated gas hazards and preventive measures, and also for the evaluation of the resource potential of the gas for its commercial exploitation. Gas desorption parameters such as *in situ* methane content sorption time, high-pressure adsorption isotherm, proximate

analysis, maceral composition, reflectance data and mechanical properties of the coal core samples collected during exploratory drilling of CBM well are determined.

Methane in Coal

Methane is derived from coal, which is both a reservoir and source rock for the gas. It is retained in coal as free gas (a small portion of the total gas content gets trapped within pores and fractures) and primarily as gas held by physical and chemical adsorption on coal matter. An important factor affecting the methane content in coal is the coal rank, which is measured by the volatile matter content of the coal or by the vitrinite reflectance. Determination of methane content as a function of volatile matter content or by reflection of vitrinite may be carried out in some circumstances. The exact determination of methane content in coal seams is carried out by the direct method of determination of methane content of coal core samples.

Sorption Time

Sorption time or Airey's time constant (t_0) is defined as the time at which 63% of the total measured gas volume is desorbed. t_0 is important to study the methane emission characteristics of coal, and is determined from desorbed gas volumes at different time intervals.

Adsorption Isotherms

The peak gas flow rate, cumulative gas recovery and the efficiency of recovery are highly influenced by the gas saturation level of the coal. The most effective method for investigating sorption of methane by coal and its gas saturation level is the determination of adsorption isotherms which show the manner in

which the amount of gas adsorbed varies with pressure at a constant temperature.

Evaluation of Coal Properties

While methane content and adsorption isotherms are most important parameters for coalbed methane production, it is also influenced by the results of proximate analysis, ultimate analysis, maceral composition and reflectance values. These parameters not only help in ranking of the coal but also in identifying its utility in generating any hydrocarbon. Standard laboratory procedures as laid down by BIS are followed to carry out the analysis.

The determination of physico-mechanical properties of coal core samples retrieved from different depths during drilling of the CBM well are undertaken at the Geomechanical Laboratory.

Standard testing procedure as laid down by BIS are followed to determine the compressive strength (IS: 9143 -1979), tensile strength (IS: 10082-1979) and Young's modulus and Poisson ratio (IS:9221-1979) of the coal core samples.

Gas Analysis and Firedamp Survey

Desorbed gas from coal samples, mine air samples and gas samples collected from inside the boreholes are analyzed for their methane and other constituents like hydrocarbons, carbon dioxide, carbon monoxide, oxygen and nitrogen.

Air quantity in an underground mine is measured with the aid of anemometer and gas samples are analyzed by gas chromatography. Frequently, the analysis results of the samples are checked by Haldane mine air analysis apparatus and Graham Lawrence apparatus.

Investigation on the methane-make survey to determine the rate of emission of methane per tonne of coal raised and general body concentration of methane in the mine is carried out in mines as per the statutes of DGMS.

Prediction of Methane Emission

Methane emission into a working district is a predictable element for both existing and planned mines. Precise prediction largely depends upon accurate knowledge of local stratigraphy above and below the working seam, maximum desorbable gas content of seam being worked and adjacent seam/strata and the method of mining. A mathematical model has been developed for advance calculation of rate of

emission suitable for application in Indian mines correlating the following parameters: (i) gas content of coal seams contributing to emission, (ii) zones in roof and floor strata from which gas is considered totally or partially to be degassed, and (iii) degree of gas emission of each contributing seam of gas bearing stratum.

A new approach has been proposed by CMRI for assessing the zone of gas emission and degree of degassing of working seams. A computer program has also been developed for calculation of rate of emission based on the developed model which has been observed to provide reasonably accurate predicted values at several collieries in India. □

Consultancy Projects taken up/completed at SERC-Chennai

The consultancy projects taken up/completed by the Structural Engineering Research Centre (SERC), Chennai, in the recent past, include:

Projects taken up

- Investigation on the cause of collapse of precast prestressed north light roof of transport shop of the western heavy workshop building of Chennai Port Trust — Chennai Port Trust, Chennai.
- Investigation on the cause of cracking in the slab of underground car parking structure of HUDCO place at Andrews Ganj, New Delhi — M/s HUDCO, New Delhi.
- Mechanical strength assessment of two \pm kV HVDC quad and two \pm 500 kV HVDC single vee insulator

string — M/s BHEL, Electroporcelain Division, Bangalore.

- Investigation for examining the strength of the existing piers and foundations and design of appropriate strengthening measures — Visakhapatnam Port Trust, Visakhapatnam.

Projects completed

- Design checking of pile foundation — M/s Gujarat Communications & electronics Ltd, Vadodara..
- Proof checking of the design of cement concrete driveway of Bharat Petroleum Corpn. Ltd, retail outlets at Chennai, Hyderabad & Bangalore — M/s Bharat Petroleum Corpn. Ltd, Chennai.
- Proof checking of the design of cement concrete driveway of Bharat Petroleum Corpn. Ltd re-

tail outlets at Indore — M/s. Bharat Petroleum Corpn. Ltd, Bhopal.

- Measurement of strains in 40 kV DC/DE type tower during test—Jyoti Structures Ltd, Mumbai.
- Scrutiny of design of 500, 600 and 800 mm dia. RSC pipes —Tamil Nadu Water Supply & Drainage Board, NRAP Division, Tiruchirappalli.
- Checking the design details of 80 m self-supporting towers including the foundation—Siemens Public Communication Networks Ltd, Gurgaon.
- Analysis and design of a 40 m tower using CFC members —M/s NSL Limited, Hyderabad.
- Investigation on damage assessment and recommendations on remedial measures for fire-affected steel structures of air heater and ESP of Kothagudam Thermal Power Station (KTPS) —Andhra Pradesh State Electricity Board, Hyderabad.
- Re-assessment of ultimate load carrying capacity of 40 m self-supporting MW tower—M/s RPG Transmission Ltd, New Delhi.
- Checking the design of 14 nos. of foundation for towers ranging

from 60 m to 90 m heights -- M/s ARM Limited, Hyderabad.

- Rechecking the design of 90 m tower -- M/s R.S. Steel Works, New Delhi.
- Checking the design and joint details of 80 m self-supporting towers including checking the foundation — M/s Larsen & Toubro Ltd, Chennai.
- Proof checking the design of pile foundation—M/s Gujarat Communications & Electronics Ltd, Vadodara.
- Checking the foundation design for 70 m tower—M/s Gujarat Communications & Electronics Ltd, Vadodara.
- Checking the design and joint details of 70 m MW tower —M/s Larsen & Toubro Ltd, Chennai.

Software Packages released

Computer software packages have been released to two more parties: M/s Torsteel Research Foundation in India, Bangalore [WINFRAN, RC. SLABS(G), RC BEAMS (G), RC FOOTINGS (G), RC COLUMNS (G), RC COMBINED FOOTINGS (G), RC STRIP FOOTINGS] and M/s Popular Construction, Karaikal [WINFRAN, RC SLABS, RC BEAMS, RC COLUMNS, RC STRIP FOOTINGS]. □

Research-Industry Meet to discuss Pipeline Capacity in Hydrocarbon Industry

THE Indian Institute of Petroleum (IIP), Dehra Dun, recently organized a special meet of scientists and representatives of the oil industry to deliberate upon the various approaches and technologies required to evolve a national R&D programme for optimizing utilization of existing pipelines.

The brainstorming session on pipeline transportation was the first

of its kind organized by the IIP to help evolve a national level R&D programme for harnessing and increasing the capacity of the existing pipelines in the hydrocarbon industries.

Welcoming the delegates IIP Director, Dr T.S.R. Prasada Rao said that the Scientific Advisory Committee (SAC), set up by the Ministry of Petroleum and Natural Gas, has always been actively encouraging in-

digenous R&D. The Technology Session, he said, has been arranged on the advice of Prof. M.M. Sharma, Chairman, SAC, to tackle the problems in pipeline transportation through a multi-disciplinary approach.

Prof. K. Vasudeva of IIT-Delhi was Chairman of the Technology Session. He said that the government's role in supporting R&D through the SAC has always been encouraging. This session, he said, would be a prelude to the formation of a smaller forum which could put forward specific project proposals before the SAC.

Although a lot of work has been going on in several organizations like ONGC, IOC, Engineers India Ltd and different national laboratories in the area of pipeline transportation, the meet organized by IIP would help assess whether this work has been adequate.

A presentation made by Shri N. Prasad, DGM, IOC, gave an overview of the corrosion and inspection systems in the pipeline network of the IOC. Dr K.C. Kaushal, GM, ONGC, gave an overview of the Bombay High Platform and flowlines network and the corrosion problems relating to the same.

Shri A. Jayaraman, Scientist, IIP, made a brief presentation on the studies relating to pipeline transportation being carried out at IIP. He laid stress on the need for updating the calculations made at IIP during 1989, based on field data, giving the critical flow velocity above which water entrainment in oil leads to no corrosion.

The session concluded with the recommendation for the formation of a small team which would make concrete proposals to be put up before the SAC. □

Sophisticated Food Safety Analysis Facility at CFTRI

A state-of-the-art analytical instrumentation facility for analysis of processed foods to world standards has been set up at the Central Food Technological Research Institute (CFTRI), Mysore. The facility was declared open by Dr (Smt) Manju Sharma, Secretary, Department of Biotechnology, Government of India, on 9 March 1998.

Set up with an outlay of Rs 29.9 million, the facility houses highly sophisticated instruments such as: Atomic Absorption Spectrometer (which can analyze heavy metal contaminants in food); High Pressure Liquid Chromatograph; Gas Chromatograph; Infra-red Spectroscopes; High Performance Thin Layer Chromatograph (for detection and measurement of chemical contaminants such as pesticides); Liquid Scintillation Counter (for studies on metabolism of food ingredients using radioactive tracers); Spectrofluorimeter (for studying interaction of food substances with biological molecules in the human body), and the Spiral Counter (for rapid analysis of microbial load in food products).

The facility sponsored jointly by the Department of Biotechnology and the Ministry of Food Processing Industries assumes great importance for the food processing industry in the light of the recent adoption of Hazard Analysis and Critical Control Point Standards (HACCP) for processed foods by the Bureau of Indian Standards and the necessity to contain pesticide residues in fresh fruits to be exported from India. □

CMRI Foundation Day

THE Central Mining Research Institute (CMRI), Dhanbad, celebrated its 43rd Foundation Day on 10 May 1998.

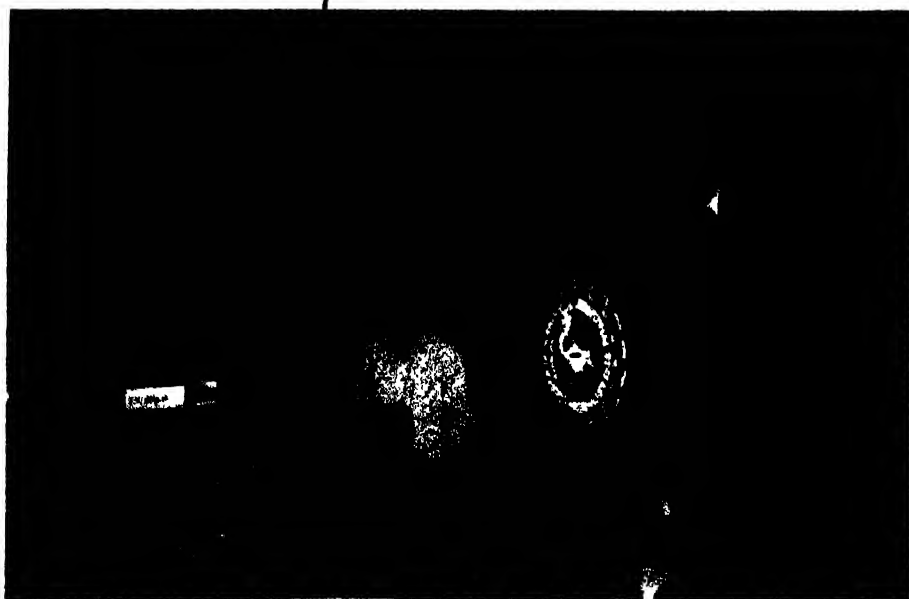
Shri Satya Brata Sinha, Justice, Calcutta High Court, who was the Chief Guest on the occasion, delivered the Foundation Day Lecture on 'Role of CMRI before and after coal mines nationalization'. He urged the scientists to invent suitable coal mining technology so that coal could be produced at a cheaper cost. According to him, nationalization is gradually becoming the event of the past and more and more countries are embracing the policy of globalization. He asserted that CMRI could play an important role to make the Indian mining industry more competitive, more environment-friendly and more safe.

Earlier, while welcoming the Chief Guest and participants, Dr T.N. Singh, Director, CMRI, said, "Celebration of Foundation Day should not merely be a formality. Rather, it should be the day of introspection for what we have achieved and what more we can do in future for the

nation". He opined that CMRI scientists should establish enough credibility so that industry would seek the CMRI technology. It would not only help checking the inflow of foreign technology but also help CMRI fend for itself. He added, "Today, earn your own bread" has become a buzz word because Government of India is gradually cutting down the subsidy in different fields.

One added attraction of the day was inauguration of 'Senior Citizen Forum of CMRI', the brain child of Dr T.N. Singh. It has been formed to maintain link with persons retired from the institute. Henceforth, retired persons will be invited on different occasions at CMRI to deliver lectures in different courses. Thus, the existing staff members will benefit from the vast and valuable experience of the retired persons.

At the end, Dr Singh presented a memento to the Chief Guest. Shri M.N. Tarafder, Scientist, CMRI, proposed a vote of thanks. The entire programme was compered by Shri S.K. Gupta, Scientist-in-Charge, BDIL Services of the institute. □



Shri Satya Brata Sinha delivering the Foundation Day Lecture at CMRI. Sitting on dais (from left) are: Shri M.N. Tarafder, Dr T.N. Singh and Shri S.K. Gupta

CIMAP celebrates Annual Day

THE Central Institute of Medicinal and Aromatic Plants (CIMAP), Lucknow, celebrated its 39th Annual Day on 30 April 1998. Dr R.S. Thakur, former Director, CIMAP, presided over the function.

Presenting the R&D accomplishments during the year 1997-98, Dr Sushil Kumar, Director, CIMAP, said that in order to further boost up the production of quality mint oil in the country, another high yielding variety 'Kosi' has been developed and released to more than 100 farmers during the year. The variety 'Kosi' matures 10-15 days earlier than the existing cultivars and gives about 20% more oil yield with about 81% of menthol, the major constituent of the oil. Besides, three varieties of Khus (Vetiver), namely 'Dharini', 'Keshari' and 'Gulabi', have been developed by CIMAP. While the oils from varieties 'Keshari' and 'Gulabi' have saffron- and rose-like fragrances respectively, the oil from var. 'Dharini' gives peculiar khus-like odour. Dr Kumar further informed that a new variety of isabgol named as 'Niharika' has also

been developed. Regarding the anti-malarial drug obtained from plant *Artemisia annua*, Dr Kumar said that an economic process for the conversion of artemisinic acid into artemisinin with about 40% yield has been perfected. Also, the semi-synthesis of side chains of taxol and taxotere has been made possible. Taxol is the life saving drug used for the treatment of the ovarian cancer.

In the area of human resource development and technology utilization, CIMAP has trained more than 300 farmers and entrepreneurs in cultivation, processing, quality control, marketing, etc. of medicinal and aromatic plants by holding seven training programmes. Besides providing scientific and technical information, planting materials, books and bulletins published by institute, testing and analytical services in the area of medicinal and aromatic plants were made available to more than 3000 people. CIMAP has published 103 research papers and filed 29 patents including nine international patents.



Dr Sushil Kumar, Director, CIMAP, addressing the gathering during the Annual Day Celebrations of CIMAP. Sitting on dais (from left) are: Dr R.S. Thakur and Dr H.K. Srivastava

In his address, Dr R.S. Thakur lauded the efforts made by CIMAP and said that the technologies developed by the institute have proved beneficial to thousands of farmers, entrepreneurs the country. Dr Thakur also gifted his collection of some precious international journals and books to the CIMAP library. On this occasion, the annual report of CIMAP for the year 1997-98 and two farm bulletins one each on the medicinal plant 'senna' and aromatic plant *Tagetes* were also released.

Dr H.K. Srivastava, Deputy Director, CIMAP, proposed a vote of thanks. □

ITRC celebrates World Environment Day

THE Industrial Toxicology Research Centre (ITRC), Lucknow, celebrated World Environment Day on 5 June 1998. The theme of the event was 'Life on Earth — Save Our Seas'.

The event was inaugurated by Shri Dharmendra Dev, IAS, Principal Secretary, Department of Science and Technology, U.P. A seminar was also organized on the occasion in which ITRC scientists and research fellows participated.

Dr P.K. Seth, Director, ITRC, in his welcome address said that in this city, there are four CSIR laboratories, viz. CDRI, CIMAP, NBRI and ITRC. We also have a field centre of CFTRI and a Polytechnology Transfer Centre. These CSIR institutions can team up and take up projects related to environment, food and health. He drew attention towards the chemicals, producing estrogen like activities, termed as Endocrine Disrupters. Adverse effects of these

on wild life and humans have been reported world wide. These chemicals include pesticides, industrial chemicals, dietary substances, phytoestrogens, and heavy metals. Regulation of use of such chemicals is very important and their accumulation and built up should be contained. Both industrialization and food production has to continue but with proper planning and adopting scientific approach. We should assess the carrying capacity of the city and industrial areas in terms of type of industries, population, area, and geographical situation, and draw proper Environment Management Plans. We should also conserve our resources. e.g. water. In our cities, we find taps are left open or leaking, and the pipe lines rusted, even broken. Prevention of such practices would not only conserve water but add safety and avoid contamination of the water. Use of pesticides has to be regulated. New formulations are needed which are slow release and degradable. ITRC is going to take up such projects. Our future plan is going to be research for prediction and prevention through bioremediation. ITRC is prepared to offer plans which could be easily adopted and implemented by the government agencies.

Dr Krishna Gopal, Scientist, ITRC, spoke on 'Environmental management on the disposal of hazardous solid wastes'. He said that the state government had sponsored a project to ITRC on hazardous waste management and selecting an ideal site for landfill of hazardous solid wastes in the districts of Lucknow, Moradabad and Bulandshahar so that environmental pollution was controlled. Other districts of UP will be included in this study.

Dr S.K. Bhargava, Scientist, ITRC, said that owing to vehicular

pollution in Lucknow, the ambient air quality as well as the noise level of the city have exceeded the permissible levels. Thus, the normal health and life of common man is in danger. A random survey of Lucknow was conducted during summer 1998 regarding air, water and noise pollution. Report of the survey entitled 'City Pollution and Management for Lucknow' was released on the World Environment Day.

Prof. R.R. Verma, Vice Chancellor, University of Lucknow, delivered the presidential address. He stressed upon the need for preventive measures with particular reference to cases of fluorosis in children exposed to high level of fluoride contamination in drinking water. He also released a book entitled '*Paryavaran Sangrakshan, Pradushan, Niyantaran Evam Swasthya Naye Aayan*'.

Dr P.N. Viswanathan spoke on the role of ITRC in management and conservation of environmental pollution in Lucknow. He said that safety evaluation of chemicals should be carried out before their use in the field. He described how the toxicity of pesticides persists in

the environment and ultimately finds its way to human beings either through the food or drinking water posing health hazards.

On the occasion, a debate was organized for scientists of the local CSIR laboratories. The winners of the debate on 'Environment and Health' were awarded prizes by Shri Dilip Kumar, IAS, Principal Secretary, Department of Environment, U.P. There were six participants in the debate. The prize-winners are : (i) First Prize — Dr A.B. Pant for 'Hospital waste management and public health', (ii) Second Prize — Shri Manoj Kumar for 'Paryavaran and Swasthya', (iii) Third prize — Shri A.K. Pandey for 'Vriksh hi Jiwan hai'. The consolation prize was awarded to Ms Rashmi Saxena.

Dr S.A.H. Abidi, Director, Central Institute of Fisheries Education, Mumbai, while delivering a guest lecture, threw light on the environmental awareness in oceanology.

Dr R.C. Srimal, Emeritus Scientist, ITRC, expressed his views on practical problems in pollution abatement.

Dr Krishna Gopal, Scientist, ITRC, proposed a vote of thanks. □

TRAINING PROGRAMMES

Testing of Road Construction Materials and Quality Control Aspects

THE Central Road Research Institute (CRRI), New Delhi, organized two training programmes on 'Testing of Road Construction Materials and Quality Control Aspects' for the Civil Engineers of IRCON International Ltd, New Delhi, first during 24 February to 10 March 1998 and the sec-

ond, during 23 March to 3 April 1998. Both the programmes were inaugurated by Dr S.M. Sarin, Acting Director, CRRI, and were attended by about 25 participants earlier posted at Konkan Railway Project and presently employed by IRCON International.

Welcoming the participants, Shri R.S. Bharadwaj, CRRI, said that such training programmes are intended to make the participants aware of the latest techniques and technologies, enabling them to use the acquired knowledge in actual practice.

Shri P.K. Nanda, CRRI, while addressing the participants stressed the application of road building technology. He emphasized the need of quality control checks during pre-construction and post-construction periods. He also stressed that the durability of roads can be enhanced by proper quality control measures including testing procedures, proper testing equipment and novel construction techniques.

Dr Sarin, in his address, advised the participants to derive maximum benefit from training programmes and maintain contact with the institute for continued interaction.

Training was imparted through modern training aids like audio-visuals, testing and laboratory demonstration, visits to construction site and discussions on theoretical aspects. Emphasis was laid on materials for bituminous and cement concrete road construction aspects, testing of soils, mastic asphalt and the demonstration of riding quality devices, indigenous equipment for functional and structural evaluation of road pavements and non-destructive testing.

At the concluding session, the trainees were given opportunity to express their opinion regarding the programme. □

International Training Course on 'DNA Finger Printing'

ADVANCES in biotechnology are poised to have a far-reaching impact on the quality of human life and environment. DNA finger-printing has been one of the remarkable applications of biotechnology and is today the most sensitive and reliable means available for individual identification, paternity tests and application in forensic science. Histocompatibility testing by DNA analysis will soon revolutionize the way organ procurement agencies cross-match donors and recipients. Since the tests performed by DNA diagnostic laboratories and by crime laboratories can have a significant impact on genetic counseling and the outcome of trials respectively, it is important that test procedures used by laboratories possess a high degree of accuracy and reproducibility.

In view of the increasing importance of DNA fingerprinting, a training course on the same was held in the recent past at the Centre for Cellular and Molecular Biology (CCMB), Hyderabad. Organized by the NAM S&T Centre, the course was held at the Centre for DNA Fingerprinting & Diagnostics (CDFD), and was cosponsored by the Federation of Asian Scientific Academics and Societies (FASAS).

In addition to many participants from India, one representative each from Bangladesh, Egypt, Nepal, Pakistan, Zambia, Malaysia and two participants from Sri Lanka participated in the course.

The resource persons for the course were drawn from the faculty of CDFD and CCMB.

During the inaugural session, Dr Lalji Singh, Head, CDFD (pres-

ently Director, CCMB) and Course Director, presented the genesis of the workshop and latest developments in DNA fingerprinting as a tool for diagnostics and for forensic applications.

The participants presented reports on the present status and future plans for DNA fingerprinting and its application in their respective countries. Dr Md. Mohebbullah from Bangladesh, Ms Somaia Mohamed Ismail Salasa from Egypt, Mr Abdul Rahim Bin Abdul Mutalib from Malaysia, Mr Jiwan Prasad Rijal from Nepal, Mr Zia Ur Rahman from Pakistan, Dr Fernando Sirimali and Dr P.K. Samarajeewa from Sri Lanka and Mrs Linda Sikawa from Zambia presented the status report and plans for their respective countries.

The course comprised ten presentations covering bacterial genetics, human genetics, population genetics, statistical analysis, structure of DNA, principles and applications of DNA fingerprinting, polymerase chain reaction (PCR), detection of genetic disorders by restriction fragment length polymorphism (RFLP), automated fluorescence analysis of RFLP and automated DNA sequencing.

The course included practical work on propagation and maintenance of bacterial strains, isolation of plasmid and bacterial DNA, vector-hot systems, molecular cloning, automated DNA sequencing and DNA fingerprinting of samples of human, animal and plant origin including isolation of DNA, restriction digestion gel electrophoresis, southern blotting, preparation of radioactive and non-radioactive probes by various techniques, blot hybridization, autoradiography and phosphor

imaging, enzymatic detection and interpretation of DNA fingerprinting patterns.

The participants underwent hands-on training and also carried out experiments under expert guidance. They found the course very intensive and useful in developing

and strengthening their own DNA fingerprinting programmes.

The participants also attended a one-day symposium on Genome Analysis: Recent Trends and Applications, which was organized at CCMB.

sional registration with the District Industries Centre were discussed by its representative.

In addition to theoretical lectures in the elementary ceramic subjects, practical training and demonstrations on standard ceramic practices were also conducted coupled with visits to different ceramic units.

Special Entrepreneurship Development Programme in Ceramics

THE Central Glass & Ceramic Research Institute (CGCRI), Naroda Centre, Ahmedabad, conducted a Special Entrepreneurship Development Programme (SEDP) in Ceramics during 23 February to 27 March 1998, under sponsorship of the Department of Science & Technology, New Delhi. The programme was attended by 23 engineering & science graduates and diploma holders.

The programme was inaugurated by Shri S.B. Vora, General Manager, Gujarat Mineral Development Corporation (GMDC), Ahmedabad. The following aspects were discussed by the experts from Commissionerate of Industries and Centre for Entrepreneurship Development, Ahmedabad: The scope and objectives of SEDP; The basis of selection of projects; Characteristics of an entrepreneur, achievement and motivation training, etc.

The faculty members were drawn from CGCRI's Naroda Centre, Commissionerate of Industries, Gujarat Industrial Development Corporation and Gujarat Electricity Board as well as from the ceramic industry in Gujarat. Various topics like financial management including cost of projects, assessment of working capital, outline of financial

accounting, breakeven analysis, etc. were highlighted.

The subjects regarding various elements of ceramics, like occurrence and selection of raw materials and their preparation, formulation and preparation of different types of ceramic bodies, plaster of Paris and making of moulds, different forming techniques, drying of ceramic wares, ceramic glazes and colours, kiln furniture, ceramic kilns and firing operations, decoration of ceramic wares, etc. were discussed in detail. Various schemes for the manufacture of traditional ceramic wares like wall tiles, artistic stoneware, sanitaryware, improved stoneware crockery, bone china and normal steatite porcelain, etc. were discussed by the faculty from CGCRI's Naroda Centre.

The experts from State Bank of India, Small Industries Development Bank of India and Gujarat State Financial Corporation discussed the financial assistance available from banks and financial institutions for setting up new ceramic units in Gujarat. Rules and regulations pertaining to sales tax, income tax, labour laws and factory acts were discussed by experts invited from Sales Tax, Income Tax and Labour Commissioner's Offices. Formalities related to provi-

The participants expressed their satisfaction over the course content and stated that they got all the relevant information on setting up of new enterprises in the small scale sector. They also expressed their satisfaction over the full co-operation received from all the staff members of CGCRI's Naroda Centre. They felt that in spite of their being illiterate in ceramic subjects, the topics were dealt with so well that they could understand the same without any difficulty which will help them in quality improvement and sale of ceramic products. They suggested that the SEDP to be conducted in future may include commerce graduates also.

The Chief Guest at the valedictory function, Shri J.V. Bhatt, Additional Director (Tech.) CGM, Government of Gujarat, gave away certificates to the participants. Shri Bhatt spoke about the impact of the programme on employment generation and rapid industrialization in the State. He appreciated the activities of the Centre and the efforts being made by it for the upliftment of ceramic industries in Gujarat.

CGCRI Training cum Demonstration Programme on Rural & Pottery

A Training cum Demonstration Programme was organized at the Central Glass & Ceramic Research Institute (CGCRI), Naroda Centre, Ahmedabad, to transfer the technologies developed for diversification of rural pottery under the DST-sponsored project 'Improvement in Productivity and Quality of Rural Pottery in Sabarkantha & Kheda Districts in Gujarat as well as Development of Appropriate Technology for Diversification', to the Rural Technology Institute (RTIG), Gujarat, Gandhinagar, during 25-30 May 1998. Six personnel from RTIG attended the programme.

The programme consisted of theoretical lectures and practical demonstration on various aspects of the production of some unglazed terracotta items, viz. (i) Flower and garden pots, (ii) Clay flooring tiles, (iii) High strength black pottery as well as glazed terracotta items, (iv) Crockery and tableware, (v) Facing and decorated facing tiles, and (vi) Flower vases and decorative articles.

The programme started with the lecture 'Overview on the development of appropriate technology for diversification of rural pottery' by Dr K.N. Maiti, Scientist-in-Charge, CGCRI, Naroda Centre. He stressed the need as well as the approaches for the development of diversified rural pottery products. This was followed by a lecture on characterization and evaluation of various clays collected from the target villages of Sabarkantha and Kheda dis-

tricts by Shri B.B. Machhoya, Technical Officer. The body mixes for preparation of various items as well as frit batches were charged to give practical demonstration of the processes to the participants.

The lecture 'Development of suitable body mixes from the various body mixes studied at the laboratory level', was followed by a lecture 'Different fabrication techniques employed for shaping of articles as well as mould making from plaster of Paris' by Shri R.B.V. Subramanian. Preparation of body mixes and melting of frit in a horse-shoe furnace, were practically demonstrated.

The next lecture 'Low temperature frits and glazes' by Dr K.N. Maiti, was followed by another lecture 'The Development of low temperature glazes as well as their ap-

plication' by Shri R.M. Savsani, Technical Officer. Fabrication of articles by casting, pressing and jigger-jolley techniques was demonstrated.

The theory of ceramic firing, along with the modern kilns and firing practices, were dealt with by Dr Maiti in detail. There was also a lecture on 'Ceramic machinery and equipment' by Shri Subramanian. The practical demonstration on glazing of various articles produced during the programme and firing of the glazed products were made.

The last day of the programme was devoted to the production of the six specified items starting from the raw materials. The programme concluded with a visit to a nearby crockery unit in order to get an insight into the commercial production. □



Dr K.N. Maiti, Scientist-in-Charge, CGCRI, Naroda Centre, explaining glaze defects in the fired glazed terracotta articles to the participants of the T & D Programme at the Naroda Centre

Course on Recent Developments in Explosives and Accessories

THE Central Mining Research Institute (CMRI), Dhanbad, organized a course on 'Recent Developments in Explosives and Accessories — Their Assured Safety, Quality and Cost-effectiveness' during 18 - 22 May 1998. Twenty participants attended the course.

The Chief Guest, Shri Ramesh Khanna, Director (Technical), BCCL, inaugurated the course. In his address, he stressed on safety, quality and cost effectiveness of the usage of explosives. According to him, if we fail to achieve these parameters in explosives, it would not be possible for us to keep foothold in the era of high competition in the arena of coal production vis-a-vis the growth of explosive industries.

Earlier, welcoming the guests and participants, Dr T.N. Singh, Director, CMRI, said, "During the period 1965-75, development of explosives was highly satisfactory and it helped increase in coal production significantly. But, afterwards it has failed to keep the same pace of progress with the growth of technology in mining operations".

In this context he pointed out some of the areas where R&D is needed for development of suitable explosives, particularly for use in category III gassy mines. He expressed his full faith on the Indian scientists and said, "I am sure, they are capable enough to do so". He also spoke about the recent successful explosion of five nuclear devices by Indian scientists. Expressing his great happiness over the success, he congratulated the men behind the programme.

Shri B.N.P. Sinha, Dy. Director General (Acting), DGMS, acclaimed

CMRI scientists for developing heat resistant explosives for hot hole blasting in collaboration with the R&D Group of IBP. Other speakers during the inaugural function were: Shri D.D. Garg of Bharat Explosives and Shri R.N. Sinha of ICI.

Dr M.M. Bhattacharyya, Scientist-in-Charge, Explosives and Explosion Division of CMRI said, "If we adhere to the safety and quality norms of explosives, it would not only be possible to increase production with reduced cost but also reduce accidents to the minimum".

The Chief Guest for the valedictory function, Shri R.H. Bhalekar, Acting Chief Controller of Explosives, Department of Explosives, Government of India, while delivering the valedictory address, urged for the development of safer, cost effective, useful and eco-friendly explosives. He acclaimed CMRI not only for providing testing facilities related to explosives but also for carrying out R&D for improvement of explosives and improved techniques of blasting in mines.

Earlier, introducing the Chief Guest to the course participants, Dr T.N. Singh said that the course was organized to make both the manufacturers and users of explosives aware of the latest developments in explosives. He expressed his happiness that the course turned out to be a good forum for interaction between manufacturers of explosives, mining industry, DGMS and CMRI and generated a lot of information which would be of immense help for development of better explosives.

He also stressed upon the need for awareness on latest developments in explosives and effective blasting techniques to the grass root level of employees who are engaged in the mining industry.

Dr M.M. Bhattacharyya, coordinator of the course, summed up the outcome of the course.

At the end, Shri Bhalekar presented certificates to the course participants.

Shri R.P. Singh proposed a vote of thanks. □

Training-cum-Demonstration Programme on Glazed & Unglazed Facing Split Tiles

A training-cum-demonstration programme on 'Manufacturing of Glazed & Unglazed Facing Split Tiles' was conducted at Central Glass & Ceramic Research Institute's Khurja Centre, in the recent past. The programme was sponsored by M/s Perfect Acid Wares, Jabalpur, with a view to diversifying their existing production. These split tiles have a dewoak grooves at the back, which provide excellent grip to the wall, with ordinary cement mortar and thus these tiles serve as a real good substitute of Dholput tiles, which have the disadvantage of poor adherence to the wall.

The ten-day T&D Programme comprised theoretical lectures and practical demonstration covering the following aspects: Status of facing tile industry, Raw materials for body (source, properties, etc.), Body formulations & their processing,

Raw materials for engobe, frits & glazes and their characteristics, ceramic calculation in ceramic bodies and in glazes, Fabrication of split tiles by extrusion. Glazing, and firing of split tiles (types of kiln, kiln furniture & firing process), Defects

in body & glazes and their remedies; quality control of products and testing.

Shri R.P. Singh, Manager of M/s Perfect Acid Wares, Jabalpur, participated in the Training-cum-Demonstration Programme. □

DEPUTATION BRIEFS

Dr A. Veluchamy

DR A. Veluchamy, Scientist, Central Electrochemical Research Institute (CECRI), Karaikudi, was deputed to Japan for three months during February to May 1998, to pursue research on electrode materials for advanced 4 V lithium batteries at the Department of Applied Chemistry, Osaka City University, Japan, under the Exchange of Scientists Programme between INSA and JSPS.

Lithium ion batteries employing 4 V cathode materials are of much interest as they offer high voltage in addition to their high electrochemical capacity compared to conventional alkaline zinc-MnO₂ and nickel-cadmium batteries. Cathode materials exploited recently for lithium ion batteries are lithium manganate, lithium vanadate, lithium nickelate, lithium cobaltate, etc. With a view to improving the cycle life of lithium batteries, the cathode material composition is altered by incorporating elements such as Mn, Al and B. One such cathode material prepared and subjected to material characterization and electrochemical study in the laboratory of Applied Chemistry, Osaka, under the guidance of Prof. T. Ohzuku, is lithium aluminium nickelate. This material was studied as replacement to lithium nickelate, which in spite of being stable towards heating with organic electrolytes, during discharge in a cell results in the shrinkage of the interlayer distance followed by the formation of NiO₂ above 4.2 V with reference to lithium metal which is quite active towards organic solvents and can cause thermal runaway. In lithium

DOCTORATES

Graft-copolymerization of Some Vinyl Monomers onto Cellulose Pulp of Fast-growing Plants by Ceric Ion Initiation

DURING the last three decades or so, many fast growing annual and perennial plants with high biomass yields have been introduced throughout the world to meet the ever growing demands of raw materials for pulp, paper and other cellulose-based industries. Some of these fast growing plants, e.g. *Hibiscus sabdariffa* and *Gmelina arborea*, yield high-grade cellulose, suitable for industrial use. Shri Farid Ali, Technical Officer, Regional Research Laboratory (RRL), Jorhat, has carried out investigations on extraction of high α -cellulose pulp from the above two species and synthesis of commercially important cellulose grafted products from the high α -cellulose so extracted. The α -cellulose was characterized adopting analytical, gravimetric and spectroscopic methods, and compared with the internationally set standards for such cellulose. Vinyl monomers such as acrylonitrile and methyl methacrylate were graft copolymerized by ceric ion-initiated redox system by varying time, temperature and concentrations of

monomer and initiator, to produce grafted products with absorbent and ion-exchange characteristics. The grafted products obtained were characterized by IR, X-ray, SEM, TG, DTG, etc. Properties such as water absorbency and ion-exchange capacity of grafted products were also evaluated.

The study has established that the two fast-growing plant species can be a potential source of raw material for high α -cellulose which can be used for producing cellulose derivatives and commercially important grafted products.

Shri Ali has been awarded Ph.D. degree in Chemistry by the Dibrugarh University in Chemistry for his thesis 'Graft copolymerization of some vinyl monomers onto cellulose pulp of fast-growing plants by ceric ion initiation'. Dr C.N. Saikia, Scientist and Head, Cellulose, Pulp & Paper Division, RRL-Jorhat, was the main guide and Dr S.R. Sen, Professor and Head of Chemistry Department, Dibrugarh University, the co-guide. □

aluminium nickelate, an insulating material is formed which is believed to provide overcharge protection with its Ni^{4+} ion in its low spin states and hence prevents possible thermal runaway.

The programme of research work carried out by Dr A. Veluchamy during the exchange programme centred around the cycle life study of lithium/lithium aluminium nickelate and lithium/graphite cell employing electrolytes such as EC/DEC/LiPF₆ and DMC with LiPF₆.

A number of Li/Li Al_{1/4}, Ni_{3/4}O₂ cells were fabricated and subjected to 5 cycles from 2-4.5V and the voltage. Ah capacity profiles were monitored. The variations of electrochemical capacity with cycle number were calculated. The effect of electrolyte on the cycle life was ascertained and the feasibility of lithium aluminium nickelate for lithium battery was estimated.

The electrochemical capacity, current voltage profile, composition of graphite to construct a feasible carbon anode for lithium ion batteries were also taken up and Li/graphite cell construction and cycle life studies were performed.

The ultimate aim of the study is to make lithium ion batteries with LiC₆ as anode and LiAl_{1/4}Ni_{3/4}O₂ as cathode. This requires an in-depth study of material characterization, optimization of the electrolyte, composition and charging mode. In the Laboratory of Applied Electrochemistry, the work on this line is in progress under the guidance of Prof. T. Ohzuku in association with Associate Prof. K. Sawai and his students. The work on the development of newer Li system at CECRI is also progressing well. □

HONOURS & AWARDS

Shri A.V.S.R. Murty

SHRI A.V.S.R. Murty, Dy. Director and Head, Soil Stabilization and Rural Roads Division, Central Road Research Institute (CRRI), New Delhi, has been appointed a member of International Committee on Scour of Foundations for a term of four years.

This new Committee is a part of the International Society for Soil Mechanics and Geotechnical Engineering and is referred to as Technical Committee Number 33 (ISSMGE TC-33). The Committee aims to promote professional activities in geotechnical engineering related to scour; promote international co-operation on scour problems; develop international guidelines for scour design, monitoring and counter measures, and to facilitate the development of an electronic database of failures and successes. The Committee consists of 26 geotechnical experts from 23 different countries. □

CMRI Scientists win Halcrow Premium Award

SHRI A.K. Chakraborty, Dr V.M.S.R. Murthy and Dr J.L. Jethwa of the Nagpur Regional Centre of the Central Mining Research Institute (CMRI) have bagged the Halcrow Premium Award 1997 of the Institution of Civil Engineers, UK, for their paper 'Innovative cautious blasting technique for excavation close to a running hydroelectric power-house: a case study'.

Dr R.S. Singh

DR R.S. Singh, Head, Plant Sciences & Ecology Division, Regional Research Laboratory (RRL), Jorhat, has been

Dr T.N. Singh appointed Director of CMRI

DR Tribhuban Nath Singh, who had been officiating as Acting Director, Central Mining Research Institute (CMRI), Dhanbad, since 1 August 1997, has as-



sumed charge as Director of the institute with effect from 11 July 1998. For Dr Singh's R&D achievements please see *CSIR News*, 47 (1997), 237. It may be added here that CMRI earned a record amount of Rs 74.00 million during 1997-98 from externally funded projects. □

elected as an active member by the New York Academy of Sciences (NYAS) for his outstanding work in the area of agrobiolgy, crop production and agrotechnology, specially of medicinal and aromatic plants.

This pretigious honour is given by NYAS to scientists excelling in their speciality field. NYAS, which is celebrating 180 years of its service to Science, Technology and Society worldwide this year, has 40 Nobel Laureates among its members. □

ANNOUNCEMENTS

NAL-UNI LECTURE SERIES

Computational Aerothermodynamics

COMPUTATIONAL Fluid Dynamics (CFD) is a powerful new tool for fluid flow simulation and prediction, a tool with virtually none of the inherent limitations of other ground-based simulation techniques. It has changed the way the internal and external flow data are obtained and also the relative roles of experimentation and computation in the field of aerodynamic design and analysis. The Computational Aerothermodynamics here refers to CFD which also considers high temperature effects related to hypersonic flows.

The title course under the NAL-UNI lecture series is being organized at the National Aerospace Laboratories (NAL), Kodihalli Campus, Bangalore, during 9-11 September 1998. It will cover

Euler/Navier-Stokes equations for compressible flows — coordinate transformation; Finite volume approach — upwind techniques; Kinetic algorithm development — new trends; Riemann Solver; Implicit schemes; Boundary conditions; Multigrid technique; Coupling of CFD and computational aeroacoustics (CAA); Turbulence modelling — compressibility effects in high speed flows; High temperature effects in hypersonic flows-I/II; Euler-Boltzmann coupling in reentry flow.

Students/research scholars/scientists/engineers/technical managers who have an interest in CFD are eligible for the course. Faculty will consist of: Dr S.K. Saxena (NAL); Prof. S.M. Deshpande (IISc); Dr Sek-

har Majumdar (NAL), and Dr K.S. Ravichandran (NAL).

Course fee is Rs 3000 and 35 persons will be accommodated by registration only. Applications in prescribed form along with the course fee are to be sent to: The Convener, NAL-UNI Series.

For further details please contact:

Dr G. Prathap, Convener,
NAL- UNI Programme, or
Shri M.R. Narasimha Swamy,
Head, Technical Secretariat, NAL,
Post Bag No. 1779,
Bangalore 560 017.
Tel: 080-5086130, 5271112
Fax: 080-5260862
Telex: 0845-2279 NAL IN. □

International Symposium on Advances in Electrochemical Science and Technology

THE Society for Advancement of Electrochemical Science and Technology (SAEST) is organizing the Sixth International Symposium on Advances in Electrochemical Science and Technology at Chennai during 26-28 November 1998. The symposium will focus on the recent advances in electrochemical science and technology as applied to various industries and thus provide forum for the electrochemists and industrialists all over the world to meet and exchange information and ideas.

The symposium will aim at a realistic projection into the future of

the newer directions that the Science and Technology of Electrochemistry is likely to take in future. Papers will be presented in the following areas: Amorphous and composite materials; Bioelectrochemistry; Corrosion in bridges and multistoried structures; Corrosion and its prevention in sea water environments; Corrosion monitoring; electrochemical reactors; Design aspects of Electrocatalysis/electrocrystallization; Electroanalytical techniques including *in-situ* AFM & STM; Electrochemical sensors; Electrochromic materials; Electrorefining of superpurity metals;

High-energy density batteries/fuel cells; Plating for new functional applications and anodizing; and Pollution control.

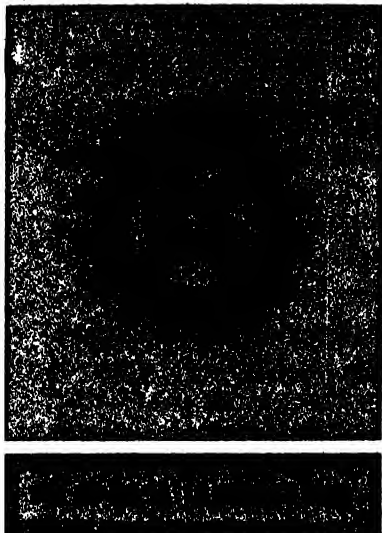
The symposium will have plenary lectures by eminent Scientists and Technologists; Technical Session (Oral), Poster Session; and Panel Discussion. An exhibition will also be arranged.

For further details, please contact: the Secretary, Society for Advancement of Electrochemical Science and Technology (SAEST), Central Electrochemical Research Institute, Karaikudi 630 006. □

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CSIR NEWS

RRL-Jorhat develops and demonstrates know-how on Arteether to FDC Ltd

UNDER a challenging sponsored assignment, the Regional Research Laboratory (RRL), Jorhat, has successfully developed the know-how for 'Arteether', a potent new generation anti-malarial drug which is active against chloroquin-resistant malaria strains. The know-how generation was in complete fulfilment of the terms of an MoU signed by RRL, Jorhat with M/s FDC Ltd, a 50 year old pharmaceutical company of Mumbai, in June 1996. Having dealt in sophisticated products like Electral (ORS), Zoxan, Ocuvir, Zocon, etc., the company, which has several commercial manufacturing plants at places like Roha, Aurangabad and Jogeswari, has been able to establish through the years a very high market reputation both in India and abroad. The know-how developed by RRL, Jorhat, was demonstrated to the representatives of the company during 23 March-2 April 1998 in the laboratory premises, at a scale of 200g artemisinin charge batch level with 58-60% yield, by a team of leading

scientists with excellent analytical back-up provided by the experts of the laboratory.

Arteether is produced from commercial artemisinin obtained from the Chinese traditional medicinal plant *Artemisia annua* in three reaction steps. Noting the novelty inherent in this scientific innovation of RRL, Jorhat, and immediate commercial prospects of the product, FDC Ltd had readily come forward to sponsor the project.

It is expected that upon successful commercial implementation of the project by the company, the technology will go a long way towards filling up the present gap of combating the disease and strengthening the country's self-sufficiency.

FDC Ltd expressed great satisfaction over the achievement of RRL team and spoke very highly about the creative efforts made scientists of RRL to transform the challenge into reality. □

R & D at IICT

Industrial Adhesives — Technologies commercialized/ demonstrated

THE Indian Institute of Chemical Technology (IICT), Hyderabad's technologies for poly-vinyl acetic emulsion adhesive and synthetic vinyl binder for distempers have been commercialized by M/s Dee Gee Chemicals, Hyderabad. Their 500 kg/batch plant was re-

cently commissioned for commercial production. Their products would be marketed under the trade names of 'Wood Fix', 'Tixi Bond' and 'Supercem Shot'.

The technology for neoprene-based contract adhesive has been commercialized by M/s Raj Adhe-

sives, Nagpur. They have been achieving a production level of 500 kg of the adhesive per month since June 1997. The trade name of the product is 'Fixsole RA 1001'.

The technologies for cyanoacrylate and isoamyl-2-cyanoacrylate adhesives are being also commercialized. In addition, the following technologies have been successfully demonstrated:

- Ecofriendly pack materials
- Pheromone lures
- Methacrylate copolymers
- PVA emulsions
- Pressure sensitive adhesive
- NBCA spray
- Pasting gum powder

CFC-113A — Technology demonstrated

1,1,1-Trichloro-trifluoroethane [CFC-113a] is a commercially important synthon for the introduction of a two carbon functionality terminating in trifluoromethyl group in bioactive molecules. CFC-113a is a key raw material for producing highly potent and less toxic pyrethroid class of insecticides like lamdacyhalothrin. Its commercial production has become the monopoly of those agencies having access to CFC-113a. The recent restrictions on the use of CFCs under Montreal Protocol has made its availability difficult for the Indian drug industry.

IICT has developed the process know-how for CFC-113a at pilot scale under an agreement with M/s Searle (India) Private Limited, Mumbai, for the development of process technologies for lamdacyhalothrin and CFC-113a. The know-how has been successfully demonstrated to M/s Searle (India) in four consecu-

tive runs on operational scale of 3 kg/batch at IICT.

CFC-113a is produced by the catalytic isomerization of CFC-113 in a tubular reactor followed by fractional distillation. The catalyst has been developed by the laboratory.

Docetaxel and Sebacic Acid — Process developed

IICT has developed a cost-effective and technologically attractive process for the production of Docetaxel, an anti-cancer drug, for CI-PLA and demonstrated it at the laboratory scale.

Also, an innovative batch process has been developed at laboratory scale for preparation of sebacic acid from castor oil. Arrangements are being made for the scale-up of the developed technology. Simultaneously, efforts have been initiated to set up a pilot scale continuous process plant at IICT for process re-standardization.

Dual Product Synthetic Pyrethroid Technology

The Indian pesticide manufacturers are facing stiff challenges on price front from imported products. The manufacturers of cypermethrin, an important synthetic pyrethroid, are under great financial strain owing to falling prices of imported cypermethrin. To meet such a situation effectively, IICT has come out with an economically attractive offer of providing a dual product technology to manufacture cypermethrin and alphamethrin in the same plant with the same feedstock.

Pervaporization Technology for Separation of Paraffins and Olefins

With the specialized expertise acquired in pervaporation technology, the institute has recently entered into contract with M/s HPCL [Vizag] for devising an economically attractive pervaporation process for the separation of paraffins and olefins to upgrade commercial propylene. The institute has already entered into contract with ISRO for separation of liquid propellant mixtures by pervaporation.

Safety Studies on LPG, Molten Sulphur and Liquid Ammonia Installations

The Process Safety Cell [PROSAC] at IICT has completed hazard analysis studies of a LPG bottling plant of BPCL, and molten sulphur and liquid ammonia process facilities. The consultancy assignments sponsored by the industry have covered safety aspects of the concerned chemical handling, identification of accident scenarios, cause and consequence analysis and HAZOP/FTA studies.

Basic Engineering of Methyl Pyrazine Pilot Plant

Under the methyl pyrazine project sponsored by M/s SPIC [Chennai] the institute has successfully completed the basic engineering of a pilot plant to be set up at SPIC [Tuticorin]. The project is being supported by the PATCER [DSIR]. The catalyst formulation is being finalized for pilot plant trials at Tuticorin, which are to start from December 1998.

Detailed Engineering Assignments

IICT's Mechanical Engineering Department has successfully completed the following three detailed engineering assignments:

- Ammonia Stripping Plant [RRL, Bhubaneswar]
- Nickel Extraction Plant [Hindustan Zinc Limited]
- Iron Oxide Pigment Plant [NMDC]

Computer-aided design facilities have been employed for the above assignments. □

Higher Yield of Alkaloids from *Catharanthus roseus* Leaves

THE Madagascar periwinkle, *Catharanthus roseus* (L.) G. Don. is well known as a source of a number of clinically useful alkaloids, particularly vinblastine and vincristine, the bis-indole alkaloids, find use in cancer chemotherapy. As these are minor alkaloids, their yield is restricted to around 1 g and 20 mg/1000 kg respectively. The isolation of these compounds from leaves being a very tedious job is a field of interest worldwide. The currently used methodology employs solvent extraction by partitioning the alkaloid bases and their salts between organic and aqueous phases which is very sensitive to pH and depends upon the solubility of particular compound in more appropriate solvent layer. Consequently, its sensitivity to variations in temperature cannot be ruled out. As much scientific information is not available in

New Contracts signed by IICT

THE Indian Institute of Chemical Technology (IICT), Hyderabad, signed 41 new contracts during 1997-98, of which nearly 30 contracts were with private and public sector industries and the rest were grant-in-aid and Industry-government joint programmes. Their total contract value is Rs 42 million with nearly 88% financial contribution from the industry. The IICT's overseas contracts have also registered more than 100% growth. The contracts signed during October 1997 - March 1998 include those related to:

- Enhanced performance studies for bulk drug effluent treatment plant
- Processes for Donepezil, Troglitazone, Sildenafil, Raloxifene and Cerivastatin drugs
- Molecular sieves (zeolites) for the synthesis of speciality and fine chemicals
- Risk analysis of liquid ammonia pipe line from wharf and storage facility
- Kairomones in the integrated pest management of yellow stem borer and plant hoppers in rice and spotted boll worms in cotton crops
- Process for orthoaminophenol
- Process for vanillin
- Basic design for anaerobic adhesives
- Process for anaerobic adhesives
- Sericulture as a biotechnological tool for employment of women in rural areas of RR District (A.P.)
- Microbial studies to develop consortium of microorganisms to treat industrial effluents
- Continuous monitoring of coal quality for Singareni collieries
- Risk analysis of bulk drugs manufacturing unit
- Process for a rubber-based adhesive
- Process for nitration of toluene
- Process know-how for furfuryl alcohol from furfural
- Basic design of demonstration plant for a biopesticide
- Data Base Management Systems (DBMS) for sericulture
- Processes for sodium acetylde and triphenyl phosphine
- Process for benzaldehyde/benzoic acid by air oxidation of toluene
- Pharmaceutically active molecules
- Novel process for a new anti-asthmatic drug □

this direction, investigations have been conducted at the Central Institute of Medicinal and Aromatic Plants (CIMAP), Lucknow, to study the effect of ambient temperature and pH of extraction on the isolation of these alkaloids.

The studies carried out at the institute have shown that pH and temperature are important param-

eters affecting the isolation of total alkaloids from the leaves of *C. roseus*. The percentage of total alkaloids is higher at 42°C than at 26°C and increases with pH (from 8.5 to 9.0). These findings will help in the studies aimed at developing a rapid procedure for the quantitative isolation of medicinally useful alkaloids from this plant. □

Action Plan for Transfer of Technology on Engineering of Structures for Mitigating Damage due to Cyclones

THE Structural Engineering Research Centre (SERC), Chennai, had successfully completed a United Nations Development Programme (UNDP) assisted project on 'Engineering of Structures for Mitigating Damage due to Cyclones' during 1992-95. Based on the R&D results of the project, expertise, methodologies and guidelines for safe and economical design of residential, industrial and institutional buildings in cyclone-prone areas were developed. The UNDP Evaluation Mission recommended that SERC, Chennai should be recognized as a Centre of Excellence for Engineering of Structures for Mitigating Damage due to Cyclones in South Asia Region. It was felt that the expertise and methodologies developed to reduce damage to buildings and structures should reach the people in the cyclone-prone areas. Keeping this in view, an Action Plan for Transfer of Technology, funded by UNDP, was taken up with major thrust on conducting a number of community-based contact programmes at various centres along the cyclone-prone coastal regions of

the country. A number of Nodal Centres, essentially drawn from academic institutions, government organizations and non-governmental voluntary organizations, who are interested in the area of cyclone disaster mitigation were coopted as partners for transferring technology in different regions along the cyclone prone coastal districts. Community-based contact programmes were organized at Nagapattinam, Sirkali and Thanjavur (Tamil Nadu); Pondicherry; Nellore, Gudur, Kavali, Papatla, Machilipatnam, Gudivada, Bandar, Narsapur, Visakhapatnam, Nagarjunanagar, Maripalem, Pasumarthivariapalem and Rajupalem (Andhra Pradesh); Berhampur, Bhadrak, Bhubaneswar, Kendrapara and Konark (Orissa); and Calcutta. Over 1500 people have been trained from different cyclone-prone regions of the country through these contact programmes. A booklet on '*Guidelines for Mitigating Damage to Dwellings due to Cyclones*' brought out in English, Hindi, Tamil, Telugu, Oriya and Bengali was extensively used during these programmes. In addition, four

different posters giving details of improvements for building layouts for roofs and walls of buildings to reduce damage owing to cyclones were also brought out in English, Hindi, Tamil, Telugu and Oriya and were widely distributed.

Other activities under the Action Plan comprised:

1. Construction of four types of exhibit-cum-demonstration buildings with the cyclone-resistant features at three centres — one at SERC, Chennai, and two others at Visakhapatnam and Nellore at sites belonging to Andhra Pradesh State Housing Corporation Limited. The four types are: non-engineered thatched building, tiled building, building with AC sheet roofing and building with reinforced concrete roofing.

2. Publication of a book on '*Guidelines for Design and Construction of Buildings and Structures in Cyclone Prone Areas*', incorporating chapters on cyclone scenario in India, damage surveys and assessment, wind loading on buildings and structures, materials and methods of construction, guidelines for design of cyclone-resistant buildings and structures, guidelines for detailing of reinforcements to reduce damage to concrete structures, and simple techniques and guidelines for cyclone-resistant construction. The book also contains examples on design of cyclone-resistant dwellings, lamp masts and a typical steel truss and also data sheets meant for carrying out survey in cyclone prone villages..

3. Publication of a booklet on '*Damage to Buildings and Structures due to Kakinada Cyclone*'.

4. Survey of 30 villages on cyclone prone east coast in Tamil

Nadu, Andhra Pradesh and Orissa. The nodal centres and other local organizations have helped in collecting the survey data from different villages in these regions. A database on the different type of buildings

evolved by the community is available for further studies, particularly with reference to retrofitting measures for improving their cyclonic resistance. Based on the data collected in the survey, a database

has been created, which will help in evolving guidelines for improvements in construction work in future. These have also been documented as a compendium. □

NATIONAL PHYSICAL LABORATORY, NEW DELHI

R & D Highlights: 1996-97

THE National Physical Laboratory (NPL), New Delhi, pursues its R&D programmes in the following broad areas: Physico-mechanical and Electrical Standards, Materials Development and Characterization, Low Temperature Physics, and Radio and Atmospheric Sciences. Establishment, Maintenance and Improvement of National Standards of Measurements, and to realize the 'Units' based on International System forms a major activity of the laboratory. Work in the field of Materials Development pertains to silicon devices, interface microstructure devices, luminescent materials, display devices, liquid crystals, conducting polymers, carbon products, thin film systems and metals and alloys. Activities in the area of Materials Characterization also include preparation of Indian Reference Materials and development of analytical instruments. In the area of Low Temperature Physics, the laboratory pursues work on high temperature superconductivity, and in the field of Radio & Atmospheric Sciences, studies relate to global change, radio communication, space physics and atmospheric studies at Antarctica.

NPL maintains a close link with a large number of government departments, research organizations, academic institutes, public undertakings in India and abroad, which

support/sponsor the programme at the laboratory. These departments/organizations include DST, DBT, DAE, ARDB, DRDO, PTB-Germany, and AIT-Thailand. Some of the projects are being pursued under the joint programmes between India and countries such as USA, France, Germany and Israel. During 1996-97, the laboratory completed 12 such projects, pursued 60 projects and took up 25 new projects. A total of 28 consultancy jobs were handled for firms/organizations such as AIMIL, Samtel Co., Graphite India Ltd, Shriram Institute, ERTL, Ordnance Factory (Muradnagar), Eurolight Electricals and Director General, Light house and Ships. The calibration/testing/workshop services provided by the laboratory led to an earning of over Rs 14.7 million during 1996-97. A total of 190 papers were published. Three patents were filed: A process for the preparation of platinum/silica catalyst useful for hydrogenation reactions; A composition useful for making permanent mark on a substrate; and an apparatus useful for generation of a gas under controlled pressure.

Presented here is a brief account of some of the major activities during 1996-97.

PHYSICO-MECHANICAL STANDARDS

Length & Dimensions-- The primary standard of length is being maintained in the form of an iodine-stabilized He-Ne laser at 633 nm. A portable sturdy and compact laser cavity has been fabricated which will form part of a traveling standard. The frequency calibration facility of 633 nm He-Ne laser against iodine-stabilized He-Ne laser has been computerized by interfacing with PC. Automatic beat frequency data acquisition and analysis have been made possible with the help of a compact software developed for this purpose.

A DST project on development/fabrication of Zeeman split frequency stabilized 633 nm He-Ne laser source for precision laser-based instrument has been successfully completed. Commercially viable four units of this laser have been fabricated; the frequency stability was measured to be 1 part in 10^8 .

Under the ongoing collaborative programme with PTB, Germany, several instruments related to calibration facilities were received and installed. Bilateral collaboration programme with D.I. Mendeleev Leyer Institute for Metrology, Russia, has been approved under ILTP.

Dead Weight Test Laboratory - Calibration of precision measuring instruments was carried out for several companies and about 729 calibration certificates were issued.

Pressure & Vacuum - In-house calibration of the pneumatic pressure standard up to 12 MPa was continued as a part of the annual exercise. With a renewed interest to determine the effective area (A_0) and pressure distortion coefficient (λ) of the industrial

gauges, a computer program has been developed, which can provide the uncertainty statement (both random as well as systematic) of the industrial gauges.

Work was continued on extending the range of vacuum measurement by the NPL orifice flow system.

A computer software has been developed using QBASIC in executive mode which can be operated on any PC having DOS environment with a provision for the computation

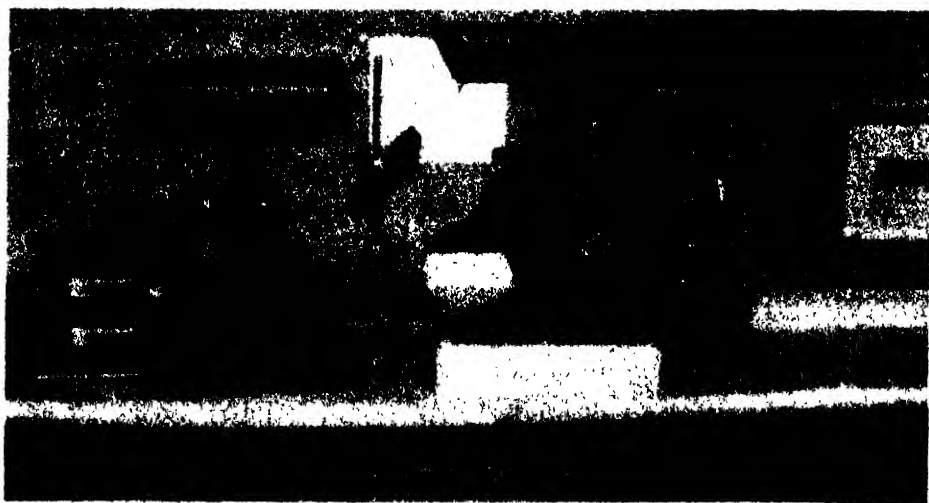
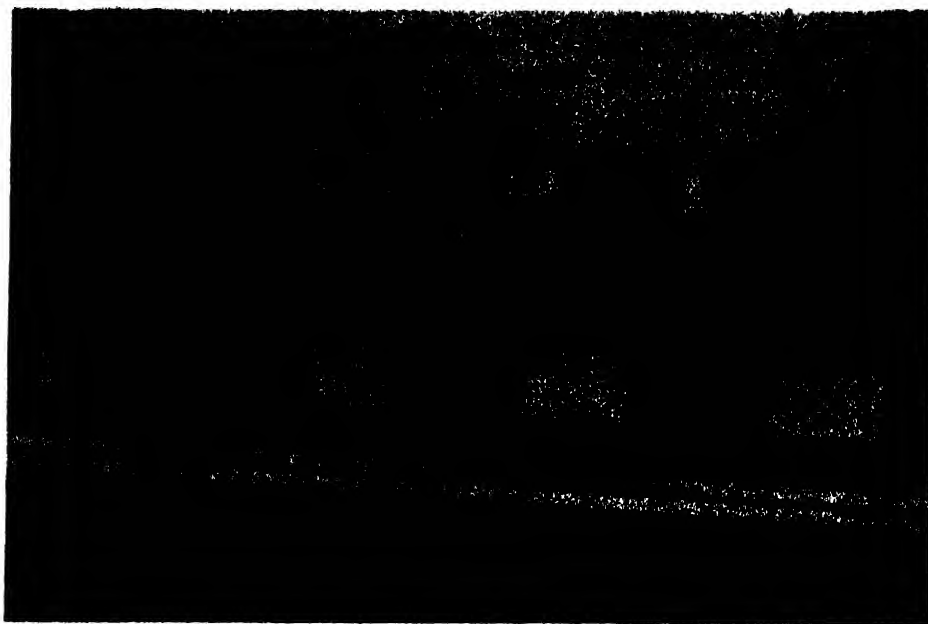
of effective area of the piston cylinder assembly experimentally as well as theoretically through dimensional measurements. This software is being successfully used in the laboratory and can also be of use in any accredited laboratory, R & D institution and industry where Dead Weight Testers are being used for pressure measurement and calibration of other gauges.

The UNDP-assisted project on 'Establishment of surface analytical facilities at NPL' has been successfully completed. The major achievements of the project have been the establishment of the Secondary Ion Mass Spectrometer (SIMS), MIQ256 CAMECA-RIBER at the Surface Physics Group and its utilization for industrial application as well as R & D activities.

A comparative study has been carried out between analytical instrumentation facility, North Carolina State University, USA and Surface Physics Group, NPL, on the doping profiles of some standard semiconductor materials like P, As, B and N doped in silicon, using magnetic sector and quadrupole base SIMS.

Standard metallic alloy sample Fe, Cr(0.25), Ni(0.20) has been analyzed by SIMS for the ratios of useful yields with respect to useful yield of Fe^+ for various primary ions (Ga^+ , Cs^+ , O_2^+). The sensitivity of Fe^+ in terms of the number of detected ions per nA of the incident beam has also been measured. These alloys are important in vacuum and steel industry. Similar work has also been done with GaAs which consists of two elements of different electronic structure.

Radiation -- Reference standards of luminous intensity and luminous flux were updated, and new



Zeeman split frequency stabilized 633 nm He-Ne lasers fabricated at NPL (top) and spectral response set-up for solar cells, having fifteen narrow band optical filters on a rotating wheel in the wavelength range 400-1100 nm.



working standards needed for day to day calibration work prepared.

Quality manuals dealing with photometric and radiometric calibration procedure followed at NPL were prepared for (1) Luminous intensity and Luminous flux measurement and (2) Spectral irradiance measurements.

Under a DST-sponsored project on coherence-induced spectral changes in optical measurements, water-cooled, 5 W, tunable argon-ion laser and a Fabry-Perot spectrum analyzer have been set up.

A collaborative project with NIST, USA, under the Indo-US Aid Programme on Total Spectral Reflectance, Total Spectral Transmittance and Spectral Emittance, study of various materials in thin and thick films and bulk samples in the infrared region has been taken up. This will enable the measurement of spectral emittance of materials at ambient temperature.

Acoustics - A new radar equation for acoustic sounding has been developed for use in the design of acoustic sounding systems and study of the temperature structure of the atmosphere.

Ultrasonics - A challenging problem of detection and location of small defects in the coaxial carbon fibre composite (CFC) material of varying thickness (3-18 mm) for testing the wings of Light Combat Aircraft (LCA) was undertaken and solved under contract research with ADA. Specially designed transducers were made for this purpose to give a -6db beam diameter of 2.5 mm throughout the sheet thickness with high transmitting and receiving sensitivities. A 'BWE Gating Technique' which gives very high and almost equal near surface

resolution for both front and rear surfaces, was also developed and successfully employed.

An improved transducer probe for ultrasonic non-destructive testing of concrete and like materials having its frequency in the vicinity of 50 kHz and based on sandwich configuration was designed, fabricated and evaluated for performance on concrete samples. Also, a complete tunable acoustic receiver was fabricated for 40 to 120 kHz with audio output using surface mount components and PCB.

Piezoelectric ceramic transducer elements in various shapes and sizes for certain specific applications have also been batch produced and supplied to user industries.

Cryogenics & Humidity Standards - A liquid nitrogen based cryosurgical probe system along with its transfer system has been tested; preliminary results are quite encouraging. Under a DST-funded project on cryosurgical system for ENT, three units were assembled and one of these was handed over to an ENT surgeon in Safdarjang Hospital, for its performance evaluation in the destruction of malignant tumours. Results on six patients have been found to be quite encouraging.

Work is being carried out to establish National Humidity Standard at NPL for providing calibration services to various industries.

Fluid Flow Measurement - Installation of a water flow measurement system (two test rigs 200 DN & 50 DN) has been completed. Both the test rigs have been tested using the overhead tank in the estimated flow range $3\text{ m}^3/\text{h}$ to $600\text{ m}^3/\text{h}$ (for DN 200) and 100 l/s to $60\text{ m}^3/\text{h}$ (for DN 50).

ELECTRICAL STANDARDS

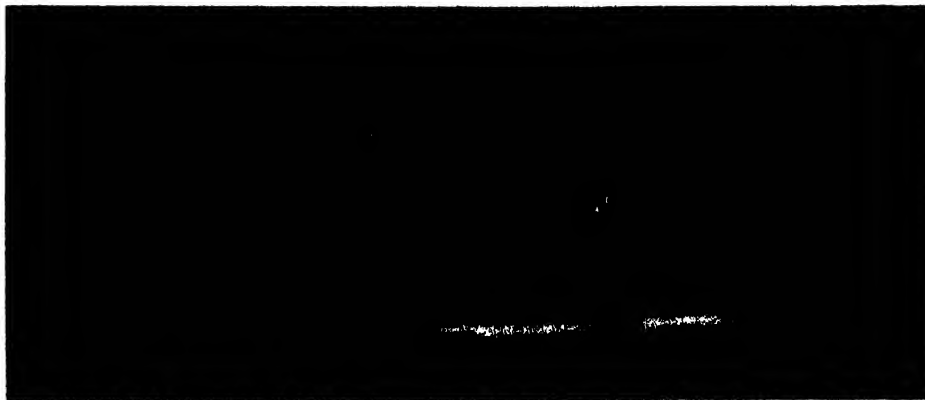
Time and Frequency - NPL continues to contribute to the generation of UTC of BIPM through monitoring of GPS time signals. It has completed a study of the reliability and availability of GPS signals in India and brought out a report. The STFS broadcast has been operational throughout the year. A low-cost STFS decoder has been developed in collaboration with ERDC, Thiruvananthapuram and STFS receiving facility installed at a number of stations in India.

Josephson Voltage Standard & Devices - Under NPL-PTB collaboration programme, several Josephson series arrays containing 1600 to 3216 Nb/Al₂O₃/Nb tunnel junctions have been fabricated and tested at PTB, Braunschweig, Germany. These chips would be used in NPL's Josephson series array voltage standard. The effect of operating frequencies on Nb/Al₂O₃/Nb Josephson series array has been studied in collaboration with ETL, Japan.

RF-SQUID sensors with microbridge of reduced dimensions ($\approx 25\mu\text{m}$) have been fabricated on Bi(Pb)-Sr-Ca-Cu-O films. These sensors have shown improved performance than earlier sensors having larger microbridge dimensions ($\approx 100\mu\text{m}$). The amplitude of voltage-flux oscillations is also considerably increased in these sensors.

An RF-SQUID system has been designed and fabricated, which is capable of measuring magnetic fields of samples kept either at LN₂ temperature or at room temperature. Detailed characterization of this system is in progress.

A high-TC superconducting microwave cavity has been designed and fabricated using dense material



Coaxial microcalorimeter system with two thermistor mounts received for intercomparison of RF power (top) and set-up for inter-comparison of LF voltage standards, under the Asia Pacific Metrology Programme

of $\text{YBa}_2\text{Cu}_3\text{O}_{7-x}$ composition. The cavity was operated in TE_{011} mode at 16.564 GHz. The quality factor $Q=31,000$ was obtained at 65K which is more than that of the best copper cavity.

HF & MW Voltage, Current, Power, Frequency and Noise -- The measurement set-up to assign the ac-dc transfer error to thermal voltage convertors (TVCs) of rating 1-1000V has been automated. Using the set-up, international inter-comparison of LF voltage standards (TVCs) has been carried out with thermal transfer standard of NML, Australia. The results of intercom-

parison have been communicated to the pilot laboratory, NML, for compilation of the final report. The other participants in the programme are South Korea, Hongkong, Philippines, Taiwan, Malaysia and Japan.

NPL has participated in the international comparison of RF power at the frequencies of 100 MHz, 1 GHz, 12 GHz and 17 GHz.

Two thermistor mounts received from the pilot laboratory, Standards and Calibration Laboratory, Hongkong, have been measured for their effective efficiency at the aforesaid frequencies, using the recently established coaxial microcalorimetric

system. The results have been communicated to the pilot laboratory.

HF & Microwave Attenuation and Impedance Standards -- A laboratory model of precision variable waveguide below cut-off (WBCO) attenuator operating at 30MHz in TE_{11} model has been designed and fabricated in 50 ohm coaxial system using precision cylindrical copper waveguide for attenuation range of 0-100 dB.

Magnetic Standards -- Steps are being taken towards setting up of a Magnetic Standards Laboratory in collaboration with PTB, Germany. The major facilities being established are apex-level calibration of H-sensors, fluxmeters, etc.

MATERIALS DEVELOPMENT

Silicon and Silicon Devices -- Work was continued for the development of high performance silicon solar cells on low-cost and low-minority carrier lifetime (τ_{ms}) substrates of area 94-100 cm^2 , using minimum number of steps. As cut wafers were textured by creating straight pyramids chemically and then diffused in a microprocessor controlled furnace in an ambient of POCl_3 , N_2 and O_2 . The junction depth and dopant profile were measured and optimized by using a new method of dopant profile analysis that does not require prior knowledge of mobility. Diffusion was followed by growth of a thin (4-5 nm) passivating SiO_2 layer and its thickness was measured by an ellipsometer. Thereafter, metallization was carried out by screen printing. Reflection loss was reduced to ~ 15% due to texturing and then ~10% by SiN_4 coating using a plasma enhanced chemical vapour



deposition (PECVD) system. A spectral response (SR) measuring set-up for 10cm x 10cm solar cells was established by mounting fifteen narrow band optical filters on a rotating wheel in the wavelength range of 400-1100 nm.

'2D DIFFUSE', a program for two-dimensional simulation of dopant impurities diffusion in silicon for microelectronic devices has been developed. The results of the simulation are in the form of impurity profiles both in vertical and lateral directions. '2D-DIFFUSE' is based on modular structure, and enables the user to have finer grids in the region where doping concentration varies sharply with distance, and to have coarse grids in the region where the change is not so pronounced without sacrificing the accuracy. It is in an interactive programme and needs inputs for mesh generation, substrate and processes etc. The output of the programme is in the form of concentration profile both in lateral and vertical directions.

Work on the fabrication of long length silver clad BPSCCO mono-filamentary, and multi-filamentary silver clad BPSCCO tapes was carried out. Multi-filamentary (6-7 filaments) tapes of up to 2m length were successfully fabricated. The mono-filamentary/multi-filamentary tapes were made by the PIT (power in-tube) method.

Development of β -alumina tubes for sodium metal production and of porous ceramic particulate filters for IC engine exhaust was initiated. The first is a collaborative project with the Indira Gandhi Centre for Atomic Research (IGCAR)

with funding from Board of Nuclear Studies. Under the project large size β -alumina tubes were to be fabricated and supplied to IGCAR for use in the electrolytic cell being developed by IGCAR for production of high purity sodium metal. Fourteen tubes of 50 mm nominal diameter have been supplied to IGCAR. In the second project, particulate filter based on porous sponge ceramics for IC engine exhaust is under development in collaboration with the Indian Institute of Petroleum (IIP), with funding from DST. Detailed sintering studies have been carried out for material synthesis and design parameters for the filter arrived at in consultation with IIP.

A DST-funded project to fabricate an automatic self locking NMR gaussmeter was completed. Several sub-systems like controller, auto range selector, digital amplitude detector and NMR resonance-to-frequency converter have been fabricated.

Microstructure Materials and Devices -- The project sponsored by the Ministry of Non-Conventional Energy Sources, for the development of electrodeposition technology for CdTe solar cells has made significant progress. The process know-how involving the Br/methanol etch and electrodeposition control has resulted in the successful fabrication of solar cells with over efficiencies. Up gradation of the process to larger area cells and lowering of contact resistivities is in progress. Commercial level technology development for contacts and encapsulation of CdTe modules has been carried out for Ecosolar Pune, which had sponsored the project. It has been provided with cell charac-

terization and evaluation know-how to optimize its production line.

A new high capacity thermal deposition system for the fabrication of CIS absorber layers by elemental co-evaporation process developed earlier for solar cell heterojunction has been set up.

The design fabrication and testing of the ion beam microetching system, including the micro manipulator, multiple ion guns and accessories, developed as part of the DST-sponsored project has been completed and technology document delivered to DST, for its commercial production.

Luminescent Materials & Devices -- Efforts were continued on a DRDO-sponsored project, 'Development of long decay phosphors and phosphor coated plastic tapes'. The long decay phosphor has been developed after preparation and evaluation of a large number of samples.

Display Devices -- A new liquid crystal laboratory has been set up to study liquid crystals.

A new technique has been developed to produce oriented nematic dispersion in polymer dispersed liquid crystals (PDLC) produced either by thermal-induced or UV-polymerization induced phase separation process.

Work on the development of Electro-chromic Devices (ECDs) for display applications using Polyvinyl Butyral (PVB)-based Solid Polymeric Electrolytes (SPEs) has established the feasibility of 'All Solid State ECDs'. A novel method of 'Self Sealing' ECDs, using the incorporated SPE as the sealant has been developed. ECDs with improved



performance characteristics, such as low operational voltage, higher contrast, fast response times and enhanced lifetime and open circuit memory, have been produced by suitably modifying the SPEs.

The conducting polymeric filters (membranes) developed from polypyrrole family of polymers were tested for virus retention on it by using Plaque Assay and Polymerase Chain Reaction (PCR) techniques by the Department of Microbiology, AIIMS, New Delhi. It has been found that some of the membranes arrest almost 100% viruses on it. The optimization process for the preparation of membranes is in progress.

Polymeric thin film-based sensors have been developed for monitoring the various gases in environment and detection of microbiological species, and their sensitivity towards pathogenic and non-pathogenic biological species and bacteria studied. Sensors prepared from polymer pellets and vacuum evaporated thin films doped with Al, Fe and Cu & Ni were tested at NPL; DRDE, Gwalior and Defence Laboratory, Jodhpur. The process parameters for batch production of polymeric thin film sensors have been standardized. Evaluation of polymer thin film sensors for CO has been carried out at CMRI, Dhanbad. The sensitivity threshold of these sensors was observed to be in the range 2-5.

Glucose biosensor developed at NPL is being marketed by Gamma Instrumentation Pvt. Ltd, Faridabad. Work was continuing on the development of urea, lactate and cholesterol biosensors.

Carbon Products -- Under an Indo-French sponsored project, oxidised PAN fibres were prepared possessing different surface energetics. PANEX fibres were characterized for their physical and mechanical properties. Work was continued on Development of carbon fibre composites illizarov ring fixator for orthopaedic applications, Oxidation - resistant carbon/carbon composites, specialty carbons, pitch fibres, brushes rocking chair carbon fibre battery, etc.

Thin Film Systems -- Diamond-like carbon (DLC) films find many applications due to their extreme hardness (30 GPa), low coefficient of friction (0.1), high transmission in the infrared and their immunity from chemical attack. DLC films with thickness more than 2.0 μm have been grown on glass substrates without delamination of the film on storage.

Metals & Alloys -- Studies are being made on the development of Advanced ALi-MMC material with low density and high stiffness for aerospace industries, in collaboration with IFAM, Germany.

Work is being also carried out on the development of cold and warm forging technology for the manufacture of automobile components.

Under a collaborative project with VSSC, Thiruvananthapuram, square tubes of Zk 30 Mg alloy were hot extruded. These tubes meet the specification required by VSSC. This exploratory work pertains to the development of payload adaptor structure of PSLV/GSLV.

The Helicopter Design Bureau of HAL, Bangalore, has been in contact with NPL for the development of oval shaped tubes to be used in its

Advanced Light Helicopter as Skid Landing Gear. The initial feasibility studies for the development of the oval tubes (reduced size) have been completed and a prototype (reduced scale) oval tube of one metre in length has been successfully produced. A project proposal has been submitted to HAL for funding the technology development for 150 x 100 mm oval tubes of about 4 m.

The DST-sponsored project 'Deformation behaviour of composite materials' has been successfully completed. Under this project, 2124 Al-alloy+SiCp Metal Matrix Composites (MMC) rods and tubes have been successfully developed with the desired mechanical target properties. An economical alternative post-processing technique for the MMC billets, made using powder metallurgy technique, has been developed, which yields extruded products with better mechanical properties.

The work on preparation and characterization of material, atmospheric chemistry and aerosols measurement was continued.

A highly sensitive method has been developed for the determination of trace quantities of germanium in wastewater of semiconductor industries.

The laboratory is participating in the IGAC project of IGBP, and also in the INDOEX programme.

Indian Reference Materials -- Work on preparation of Bharatiya Nirdeshak Dravyas was continued. Ten litre stock solution of two new Reference Materials (i) nitrate in high purity water and (ii) Multi-element standard containing copper, iron and zinc in high purity water

were prepared. Market survey was conducted to assess the need of Certified Reference Materials in the country.

FIR Emission Spectroscopy

Under a DST-sponsored programme, TGS pyroelectric infrared detectors have been developed. These have high sensitivity, good frequency response, and operate at ambient temperature.

Crystal Characterization

A powder X-ray diffractometer has been designed, developed, fabricated and thoroughly tested under a project sponsored by DST.

LOW TEMPERATURE PHYSICS

The studies in this area pertained to (i) Superconductivity in Zn-doped tetragonal $\text{LaBaCaCu}_3\text{O}_7$ systems; (ii) Low temperature specific heat of pure and substituted phases of high T_c cuprates; (iii) Order parameter dimensionality, resistivity and transition temperature in pure and Zinc-doped $\text{YBa}_2\text{Cu}_3\text{O}_{7.7}$ thin films; (iv) Excess conductivity, critical region and anisotropy in $\text{YBa}_2\text{Cu}_4\text{O}_8$; (v) Normal state magnetism of Zn-doped and oxygen deficient $\text{CaLaBaCu}_3\text{O}_7$ superconductor; (vi) Influence of F^- as additive on the crystal growth; and (vii) Effect of substrate temperature and heat treatment on the microstructure of diamond-like carbon films. A simple high precision quasi-adiabatic Nernst type calorimeter was designed and fabricated.

RADIO & ATMOSPHERIC SCIENCES

Global Change - The South Asian Regional Research Centre (SAS-RC), which coordinates the interests of India, Bangladesh, Maldi-

ves, Mauritius, Nepal, Pakistan and Sri Lanka had been functional at NPL since last two years on an ad-hoc basis. The arrangement was formalized in January 1997 with the signing of an MoU between NPL and START Secretariat, Washington, USA. The activities during the year included workshops in the areas of human dimension issues, cyclones, bio-mass, burning/aerosols & acid-rain, and hydrology of upland mountain regions.

Measurements of solar UV-B radiation, aerosol, total ozone and water vapour, were continued.

An infrared sun photometer has been designed, developed, set up and used to study the absorption spectrum of the Earth's atmosphere in the 0.8-15.0 μm wavelength range. Also, a prototype differential absorption lidar system has been designed and tested using some of the components from Laser Heterodyne system, and measurements made for surface water vapour and ozone.

Antarctic Studies - Presently, three instruments (i) Sun Photometer operating at 368, 500, 675 and 778nm for turbidity and aerosol studies. (ii) UV-B Filter Photometer operating at 290, 300 and 310 nm for UV-B studies. and (iii) UB-B Biometer UV-B range for erythema dose studies are being continuously run and data are being analyzed.

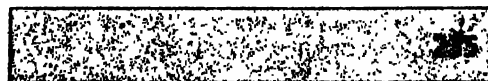
A Laser Heterodyne System using a tunable CO_2 laser as a local oscillator and sun as a source with one GHz acousto-optic spectrometer (AOS) as back end, was designed and developed at NPL and set up at *Maitri* during the 16th Indian Scientific Antarctic expedition (1996-97) to measure the vertical profiles of minor constituents in the strato-

sphere and troposphere. The observations for ozone line profiles were obtained on all clear blue sky/cloudless days. Some data for NO_2 were also collected during the summer of 1996-97.

Radio Communications - Experimental campaigns were conducted to collect HF field strength data from certain critical zones in Southern India to study the fading characteristics in HF signals. A model for estimating the rainfall rate distributions has been developed.

The daily collection of data from the Retarding Potential Analyzer (RPA) experiment, onboard SROSS-C2, was continued. Both the electron and ion RPA's were operated everyday in two high elevation orbits over the Indian region covering the latitudes -5° to 35°N (geographic), longitudes 65° to 90°E and altitudes between 430 and 630 km. Thus, RPA data have been recorded so far for more than 2000 orbits during the last 3 years after the launch of satellite in May 1994.

Radio & Space Physics - Total Electron Content (TEC) measurements using Global Positioning System (GPS) signals have been continued. As the GPS satellites are orbiting with 12 h period, TEC observed is a function of satellite latitude, longitude and time of day. A software based of Kalman filter technique has been developed, which converts the observed TEC from different satellites into vertical TEC at the observing station and varies with time of day. Day-to-day variability in ionospheric electron content observed over Delhi during solar cycles 21 and 22 has also been studied. □



National Seminar on Batteries & Fuel Cells

As a part of its Golden Jubilee Celebrations (25 July 1997 - 24 July 98) the Central Electrochemical Research Institute (CECRI), Karaikudi, organized a National Seminar on 'Batteries and Fuel Cells' at CECRI during 14-15 May 1998.

The seminar attracted a large number of personnel engaged in the R&D activities with the objective of developing cheap, high performance batteries with high energy density and long life. They comprised representatives from the leading battery manufacturers, like M/s Amararaja Batteries Limited, Tirupati; M/s Hyderabad Batteries Limited, Hyderabad; and other institutions like M/s Tractor and Farm Equipments Limited (TAFE), Chennai, and small-scale battery industries, besides scientists from CECRI. It is well known that batteries and fuel cells are the clean and efficient source of energy for the mankind

which is a struggling hard to tide over the energy crisis.

Inaugurating the seminar Dr M. Raghavan, Director, CECRI, highlighted the R&D work being carried out at CECRI towards developing different systems of batteries and fuel cells. He stressed the importance of useful interaction between industry and R&D laboratories to meet the challenges.

Dr G. Sivaramaiah, Senior Manager [Marketing], M/s Hyderabad Batteries Limited and Shri N. D. Jayakumar, Manager, R&D, M/s Amararaja Batteries Limited, Tirupati also spoke.

The papers relating to R&D work on the following topics were presented: Primary batteries; Lead-acid batteries; Lithium batteries; Electric vehicle batteries; Recycling of battery waste, Pollution control, safety and testing; Fuel cells; Alkaline secondary batteries; and Solid state batteries.

A panel discussion was also held under the chairmanship of Dr M. Raghavan.

The seminar provided unique opportunity to the scientists, engineers and industrialists from various research, academic, industrial, commercial and testing organizations to exchange views and take note of the latest developments in the field.

Dr P. G. Balakrishnan, Scientist, CECRI, and Convener of the seminar, proposed a vote of thanks. □

CFRI celebrates Foundation Day

THE Central Fuel Research Institute (CFRI), Dhanbad, celebrated its Foundation Day on 22 April 1998. Dr G. Thyagarajan, Scientific Secretary, Committee on S&T in Developing Countries, delivered the Foundation Day lecture on 'Management of R & D Systems in India : Post Globalization Challenge'. In this lecture, he pointed out that after Independence, India grew as an industrial developing country and the private and public sector industries operated parallelly. Industry was put under a protective place where competition was much less and as a result stagnancy cropped up. But after the country opted for globalization, R & D is no more in a sellers' market. Today Business Development and Marketing must be an integral component of an R & D organization. In almost all countries 'Research System' has been set up to review the R & D with particular attention towards its relationship with national economics and output, users or beneficiaries of output, level of government funding, appropriate management



Dr M. Raghavan, Director, CECRI, delivering the inaugural address during 'National Seminar on Batteries and Fuel Cells'



Dr G. Thyagarajan delivering the CFRI Foundation Day Lecture

structure and style and globalization trends and cultural adjustment. According to Dr Thyagarajan, institutional response to management has also changed. Now a days, technology forecasting exercises, strategic alliances to strengthen the innovative chain, helping the industry to cope up with technological change has become vital in R & D management. R & D centres should build up new relationship with industry in identifying, sourcing and assessing technologies from abroad. For successful Science and Technology, alliance between government, academia and industry is a must, stressed, Dr Thyagarajan.

Dr R. Natarajan, Director, Indian Institute of Technology, Chennai, and Chairman of Research Council of CFRI, congratulated the scientists and the staff members for their performance. Dr K.S. Narasimhan, Director of the institute, welcomed the guests while Shri P.K. Bandyopadhyay proposed a vote of thanks. □

WORKSHOPS

Efficient and Reliable Finite Element Analyses of Structure and Components

THE Structural Engineering Research Centre (SERC), Chennai, organized a two-day workshop on 'Efficient and Reliable Finite Element Analysis of Structure and Components' (ER-FEA' 98) in the recent past under the CSIR-KFA Collaborative Programme.

Thirty delegates from R&D organizations, academic institutions, public and private sector organizations, central and state government departments, software professional/managers participated in the workshop.

Inaugurating the workshop, Prof. R. Natarajan, Director, IIT, Chennai, appreciated the efforts of SERC in organizing this workshop

on the topic which is very vital and essential to both industry and R&D institutions.

The invited speakers were drawn from R&D and academic institutions and software organizations. Two speakers were from Germany, one from R&D institution and the other from software organization. There were 18 invited lectures, followed by panel discussion.

Dr R.N. Singh, Head, C-MMACS, Bangalore, delivered an invited talk on issues related inverse problems. Dr R. K. Bhandari, Head, ISTAD, CSIR, New Delhi, in his valedictory address commended the efforts of SERC in organizing the workshop and appreciated the progress made under the CSIR-KFA collaborative programme. □

Surface Engineering and Coatings

Asix-day International Workshop on Surface Engineering and Coatings, organized by the National Aerospace Laboratories (NAL), Bangalore, under the Government of India - UNDP Umbrella, opened at the Systems Auditorium of NAL on 25 June 1998. Over 200 delegates, including 50 overseas participants from a dozen countries attended the workshop featuring invited lectures by Indian and international experts (first three days) and a training programme on surface engineering (SE) techniques (next three days). An exhibition was also organized on the occasion.

Dr K. Kasturirangan, Chairman, Space Commission and Secretary, Department of Space, inaugurated the workshop. Dr C.G. Krishnadas

Nair, Chairman, Hindustan Aeronautics Limited (HAL), presided over the inaugural function.

Dr Kasturirangan, in his address, explained how surfaces and interfaces have acquired a special significance in materials science 'especially during the last three decades'. He talked about NAL's contributions to ISRO's satellite programme, especially in the area of thermal management, and spoke highly about the contributions of Dr S. R. Rajagopalan and Dr Indira Rajagopal. Towards end of his lecture he observed, 'applications of surface engineering are becoming more and more evident in newer and newer areas'.

Dr Krishnadas Nair, who was also the Chairman of the workshop's Steering Committee, said

that surface engineering has been an old practice which has now acquired a new name and pointed out how the ability to process and use materials was the essence of human civilization. Explaining how surface technologies have proliferated, Dr Nair discussed several examples of engineering coatings being profitably used in the design and development of the Light Combat Aircraft (LCA) and the Advanced Light Helicopter (ALH). Expressing happiness over holding the training programme for the industry as a part of the workshop schedule, the HAL Chairman said, "such exercises will promote useful linkages, because technology is always born out of the union of R&D labs and the industry.

Earlier, while welcoming the participants, Dr T.S. Prahlad, Director, NAL, gave a brief overview of the TOKTEN, UNISTAR and other programmes which supported the workshop. Dr Prahlad also paid rich tributes to the contributions of Dr S.R. Rajagopalan and Dr Indira Rajagopal during their three-decade long association with NAL.

A major highlight of the inaugural function was the illuminating keynote lecture by Dr S.R. Rajagopalan, presenting a broad brush overview of the practices and emerging trends in SE. In this lecture, Dr Rajagopalan covered wide ground: the status and future of SE, the market shares of SE technologies, SE applications in aerospace (riblets for aircraft, electrochromic coatings and the use of smart coatings as corrosion indicators). He ended his lecture by observing that SE will truly come of age once the demarcation between the surface and core disappears completely. "That will herald the dawn of the new SE era", he said

The inaugural function ended with an introduction of the programme by Dr Indira Rajagopal. Dr R. V. Krishnan proposed a vote of thanks. □

TRAINING PROGRAMMES

Low-cost Ferrocement Technology for Housing

A two-day training programme on ferrocement technology, its application and popularization in North Eastern region was organized on 5 & 6 May 1998 at the Regional Research Laboratory, Jorhat. The Ministry of Water Resources, Government of India, provided the necessary financial grant for this training programme. The programme had a series of lectures by various experts followed by practical demonstra-

tions. The resource persons were drawn from RRL, Jorhat and the Jorhat Engineering College. The trainees were deputed by the Military Engineering Services, Assam Agricultural University, Jorhat Engineering College and the Prince of Wales Institute of Engineering & Technology, Jorhat.

A tri-lingual brochure containing the salient features of the ferrocement technology was also released. □

J. C. Ray Memorial Oration

PROF. V. Ramalingaswami, National Research Professor, delivered the eleventh J. C. Ray Memorial Oration at Indian Institute of Chemical Biology (IICB), Calcutta, on 13 April 1998. This honour is bestowed every year on an eminent scientist on the occasion of foundation day of IICB.

Prof. Ramalingaswami began his lecture entitled 'Genes for Health' by paying homage to the memory of Dr J. C. Ray, the great Indian scientist with a vision. This was followed by sharing of some of the excitements that surround DNA, genes, molecular medicine and public health as we prepare to enter the 21st century. Some of the major



Prof. V. Ramalingaswami, National Research Professor, receiving the 'J.C. Ray Memorial Oration' award

benefits that molecular biology is conferring and will confer increasingly on the future health of mankind were dealt with.

The vista of gene therapy has now been opened to human exploitation and has attracted widespread interest. The new DNA knowledge enables medicine to enlarge its

range of service in improving diagnosis, in modifications designed to lessen the risk of disease and in prevention through the use of DNA vaccines and new molecules. Prof. Ramalingaswami finally dealt with tuberculosis and AIDS and related problems and perspectives. □

NEW PUBLICATIONS

***Withania somnifera* : The Indian Ginseng Ashwagandha**

THERE are nearly 2000 medicinal plants which are included in the *Materia medica* of the Indian systems of medicine and form part of the rich flora of India. Ashwagandha (*Withania somnifera*) is one such traditional ancient plant whose roots have been employed as a valuable drug in Indian traditional systems of medicine Ayurveda and Unani. In Ayurveda, the drug finds an important place in the treatment of rheumatic pain, inflammation of joints, nervous disorders and epilepsy. It is mainly indicated as an aphrodisiac, diuretic, restorative and rejuvenative drug. Ashwagandha roots are compared with ginseng roots for their adaptogenic and restorative properties and have been given the name 'Indian Ginseng'. Besides the roots of this plant, its leaves have been used as folk remedy for all types of skin lesions, ulcers and boils and in reducing pus formation and inflammation.

The cultivation of Ashwagandha in India assumed commercial proposition during the early twentieth

century. Since then, the plant has been thoroughly investigated covering all aspects from pharmacognostical identification, clinical trials and a substantial amount of scientific information relating to almost all the aspects of Ashwagandha has accumulated in literature. Many reviews/ research papers/ reports on general and specific aspects of Ashwagandha are available but the information lies scattered and fails to make a coherent reading. With a view to present the entire information relating to

Ashwagandha at one place for ready use in R&D and by industrialists and common people, the Central Institute of Medicinal and Aromatic Plants (CIMAP), Lucknow, has brought out a book on Ashwagandha. Entitled '*Withania somnifera* : The Indian Ginseng Ashwagandha' and written by Drs Sandhya Singh and Sushil Kumar, the book comprehensively compiles the information about Ashwagandha plant available in the traditional and present literature, covering more than 585 references.

It consists of about 300 pages and has been divided into seven chapters. The first chapter signifies the importance of Ashwagandha as a popular drug in Indian traditional systems of medicine Ayurveda, Siddha and Unani. The second chapter deals with international occurrence, providing knowledge about geographical distribution and various vernacular names of Ashwagandha. The third chapter gives botanical description of the plant; while the chapter four describes anatomical and pharmacognostical features of the entire plant. The fifth chapter covers the chemistry of the Ashwagandha plants giving an account of alkaloids and withanolides. The sixth chapter deals with pharmacology providing knowledge about biological activities of specific chemical constituents and variously extracted constituents of the Ashwagandha plant. In the seventh and last chapter cultivation aspects, agronomical perspectives, genetic aspects, crop improvement, plant protection measures against diseases and pests, physiological

manipulations, tissue culture aspects and genetic engineering have been critically reviewed. All the chapters are followed by concluding remarks and a common bibliography to avoid duplication.

It is hoped that this publication brought out by CIMAP will be useful to the people interested in the use of plant materials as medicine and food supplement for the prevention and cure of common diseases and to the researchers of useful secondary metabolites. □

HONOURS & AWARDS

Dr B.K.Parida

DR B.K. Parida, Head, Structural Integrity Division of the National Aerospace Laboratories (NAL), Bangalore, has been elected Fellow of the Aeronautical Society of India with effect from October 1997.

Dr Parida's name has also been listed in the fourth edition (1998/1999) of the Marquis Who's Who in Science and Engineering.

Dr M.K.Gurjar

DR M.K.Gurjar, Deputy Director & Head, Organic Chemistry-III Division, Indian Institute of Chemical Technology, Hyderabad, has been elected Fellow of the A.P. Akademi of Sciences. □

ANNOUNCEMENTS

Training Workshop on Client Server Technology Principles and Practice

OF late Client Server Technology has become the international standard for information processing, replacing the earlier technologies based on host-based mainframes and Local Area Network file servers. This has eliminated the need to use dumb, unintelligent terminals as in host based models, and also tremendously increased the throughput by the application of distributed processing, unlike LANS. A number of Relational Database Management Systems (RDBMS) are available these days like Oracle, Sybase, Ingress, Informix, SQL Base, MS SQL, etc., which incorporate the client server technology. It is therefore essential for all the people involved in Information Technology and other relevant scientific, technical and management fields to learn the rudiments of this emerging technology, so that they can apply them in their day to day work. Apart from this, the information technology is fast expanding giving rise to new features and utilities. One such feature, which has picked up very fast in recent times is the so called frontend backed technology, wherein all organizational data will be stored in the databases at the backend and the powerful frontend tools will be utilized to manipulate the database. One such easy to use powerful frontend software tool is Visual Basic.

Keeping the above factors in view, the title course being organized at the Computer Centre of Indian Institute of Chemical Technology (IICT), Hyderabad, during 5-10 October 1998, is intended

to give an introduction to client server technology, Oracle database preliminaries and the features of Visual Basic as a front-end tool, for Oracle databases.

IICT has recently established a campus-wide network with a high speed (1.2 Gbps) backbone switch, several departmental ethernet switches and powerful servers connecting about 300 clients spread over different R & D divisions, Administration and Finance. Twenty client workstations are exclusively available for training purpose and regular training programmes are conducted in computer science.

The present workshop will cover: Introduction to client server technology and computing, File processing and design of systems, Oracle 7.3, SQL, Visual Basic, Various control of VB, ODBC connectivity, ActiveX controls, and Case studies.

Administrative and Scientific staff from CSIR labs and other institutes can participate in the workshop. Prior knowledge of Windows 95 Operating System/PC Operation is desirable. A maximum of 40 participants will be taken. Faculty will consist of software professionals of the IICT Computer Centre. Fee for the workshop is Rs 6000, payable by DD to Director, IICT.

For further details please contact: Dr P.J. Reddy, Head, Computer Centre and Convener of the Workshop, IICT, Tarnaka, Hyderabad 500 007. Phone: 7151310 (Off), 7173874 Ext. 221 (Off) 7019296 (Res.), Fax: 91-40-7173387, Email: pir@esiict.ren.nic.in. □

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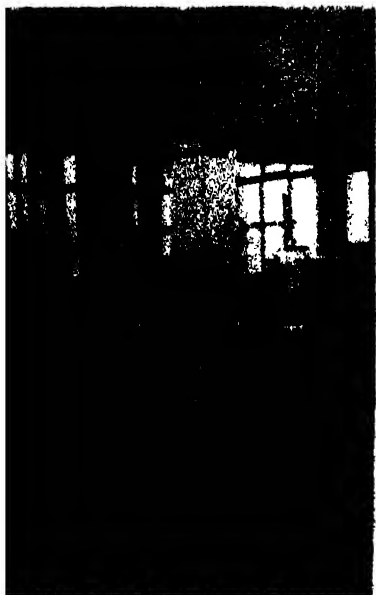
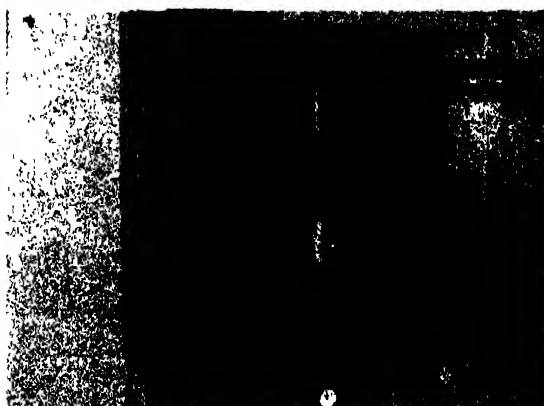
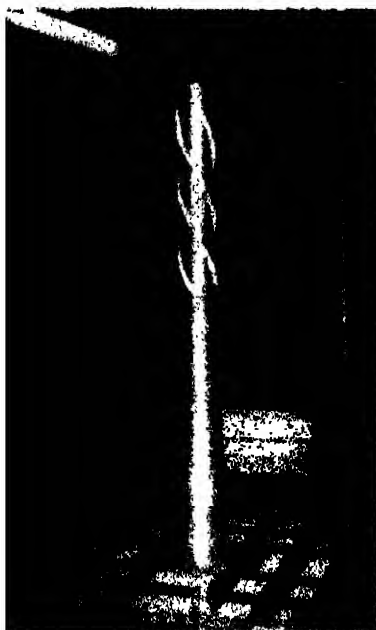
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CSIR NEWS



R&D at SERC, Chennai (Clockwise from top left): Structural model of chimney with helical strokes under wind tunnel testing; welded steel tubular T-joint under fatigue investigation; investigation of fracture behaviour of circumferentially cracked straight pipes; failure investigation of a microwave tower (centre); vibration investigation of TG foundation; and static test on RC beam-column joint with steel fibres in concrete matrix at the joint. A report on R&D accomplishments of the Centre appears on p 242

STRUCTURAL ENGINEERING RESEARCH CENTRE, CHENNAI

THE R&D programmes of Structural Engineering Research Centre (SERC), Chennai, are grouped under the following major areas: Structural Dynamics, Experimental Mechanics and Wind Engineering; Offshore Structures; Steel Structures — Transmission Line Towers and Other Skeletal Structures; Concrete Structures, Composites and Construction Engineering; and Computer-aided Analysis, Design and Software Development. During 1996-97, SERC pursued 19 in-house, 11 sponsored and 3 grant-in-aid projects. As many as 45 consultancy assignments were handled. Besides, testing services were provided for 16 towers/related hardware by the Tower Testing and Research Station (TTRS) of the Centre. Eighty-six papers were published, 11 papers were presented in various symposia/seminars and 36 technical reports were produced. The External Cash Flow of the Centre amounted to Rs 20 million, the total budget was Rs 56.65 million. Highlights of some of the major activities of the centre during 1996-97:

Following the successful completion of the SERC-UNDP Project on 'Engineering of Structures for Mitigating Damage due to Cyclones', the Centre has commenced activities on 'Action Plan for Transfer of Technology', to disseminate knowledge, expertise and technology to the various cyclone-prone coastal districts of India. Work was initiated to identify nodal centres in different cyclone affected regions and to carry out survey and collect field data on housing layouts, build-

ing types, material used, and construction techniques.

Experimental studies have been conducted in the Centre's atmospheric boundary layer wind tunnel on aeroelastic models of RC multi-flue chimneys. These included a study on using discrete and continuous strakes, as spoilers of vortices that give rise to large amplitudes of vibration. An analytical model has been developed for predicting the dynamic response of chimneys with strakes. A space grid roof inside the SERC campus is being instrumented for full-scale testing. It is approximately modelled, using special lacing technique, to a scale of 1:50 and is being studied under category 2 terrain conditions. Analytical studies have also been carried out on the pressure data obtained from the wind tunnel tests on models of low-rise buildings and industrial sheds.

Experiments were conducted to assess the behaviour of vibrating wire strain gages over long periods. Embedment type vibrating wire strain gages were embedded in a concrete cylinder. A reinforced concrete beam was instrumented with one embedded gage and two surface mounting gages. These gages, along with two other vibrating wire sensors, also kept in the same room, were continuously monitored to obtain the frequencies and corresponding temperatures. The embedded and surface mounted gages were subjected to strains due to thermal gradient in the concrete specimens. To avoid the thermal gradient effect, the concrete cylinder was immersed in a temperature-

controlled water bath. This resulted in a sensor response having a good linear variation with temperature. This temperature calibration curve can be utilized when the vibrating wire strain gages are embedded in concrete structures in the field for long-term monitoring. Studies on the behaviour and performance of bondable type high temperature strain gages at elevated temperature have also been carried out. The calibration curves for apparent strain for different materials have been prepared.

A post-disaster damage survey was conducted after the November 1996 cyclone in Andhra Pradesh. The damages caused to dwellings, buildings, life-line structures and even well-engineered structures were documented. The extreme-wind data collected from the instrumented tower in the campus were analyzed for wind, terrain and response characteristics.

In the area of fatigue and fracture behaviour of components and structures, the Centre has carried out studies on corrosion of welded steel tubular joints with cathodic protection. A knowledge-based software for preliminary design of offshore jacket towers is nearing completion. A scheme for repairing damaged tubular members/joints of the platform is under development. The grant-in-aid project on 'Corrosion Fatigue Behaviour of Offshore Tubular Joints', sponsored by Department of Ocean Development, has been completed. A project under the sponsorship of Tata Iron & Steel Co., Jamshedpur, on the performance

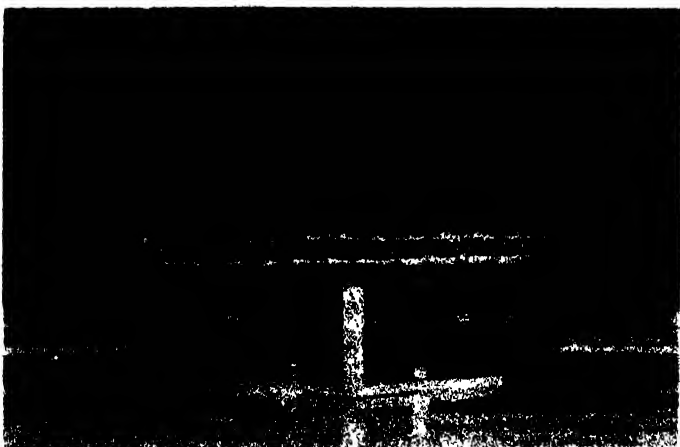
evaluation of TISCON-TMT rebars for their use in structures in seismic zones and another on 'Evaluation of TMT Reinforced Bars', under the sponsorship of the Steel Authority of India Ltd, were also completed during the year.

In the previous year, tower configurations suitable for SHS/RHS were selected, which included portable type tower with four inclined latticed masts and V-shaped guyed tower. Preliminary analysis was carried out. Weld for shop joints and bolts for field joints were considered. During the year, parametric studies on V-shaped guy tower for a

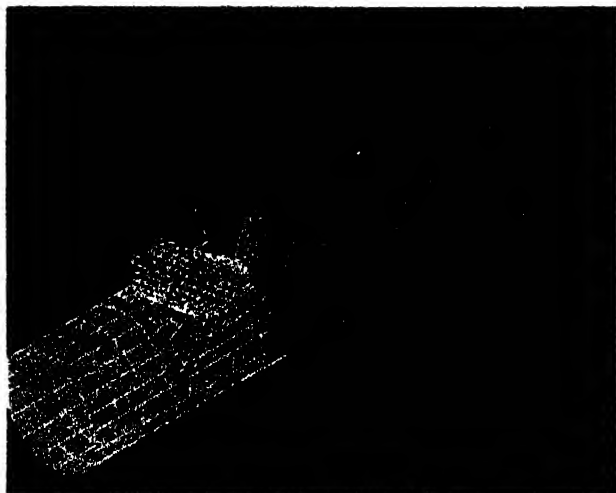
400 kV line were carried out to determine locations for guy anchors and initial tension in the guys. A few more configurations were studied for self-supporting tower. The use of RHS/SHS did not appear to offer economical solution for the towers studied, when compared to conventional sections. Two type of splice joints using bolts for leg members were designed, fabricated and successfully tested.

The Tower Testing & Research Station (TTRS) has carried out sixteen tests on towers for a number of organizations including Larsen & Toubro Ltd, KEC International Ltd,

SAE (India), and Jyothi Structures Ltd, benefiting in turn major user agencies such as the Power Grid Corporation of India Ltd, and Maharashtra State Electricity Board. An overseas contract from M/s Zelleco Engg. SDN BHD, Malaysia, was completed by full scale testing of two DC-towers with wooden X-arm, for 132 kV and 275 kV transmission line system, the beneficiary agency being Tenaga Nasional BHD, Malaysia. A sponsored research project to study the suitability of square/rectangular hollow sections for design of transmission line towers has been taken up under the sponsorship of M/s Tata Iron & Steel Co Ltd, Jam-



Clockwise from top left : Experimental set-up for studies on pile-soil interaction under dynamic loading; a cyclone damaged industrial shed roof in Andhra Pradesh; a view of tower cross arm using SHS and monitoring of buckling of critical bracing; and a scale model (1:50) of space grid roof for testing in the wind tunnel



Domain decomposition by RSB-FE mesh of multi-planar joint (left) and corrosion current measurement using 'GECOR-6'

shedpur. Typical design of towers using hollow steel sections has been completed.

Under CSIR-KFA (Germany) bilateral cooperation programme in the field of Scientific Research and Technological Development, the Centre's project proposal on 'Efficient and Reliable Finite Element' Analysis of Structures was approved for a duration of three years, and the project commenced in April 1996. As a part of the work plan under this project, two scientists from the Centre visited Germany and carried out validation studies on the computer program for 'a posteriori' error estimation and adaptive refinements for static and vibration analysis. Two scientists from IRS, Julich, Germany, visited SERC and implemented their FEM program SMART and post processor program RAPS. The German and SERC teams have discussed various aspects of algorithm for error estimation, adaptive refinement strategies, iterative solvers and their parallel implementation on SMART, and also development of graphic user interfaces (GUI).

In the area of structural dynamics, investigations carried out on pile-soil interaction have provided useful results for evolving improved guidelines for the design of machine

foundation on piles. The Centre successfully conducted an 'Advanced Course on vibration analysis and design of civil engineering structures' during January 1997, which had the participation of 37 senior engineers from academia, R&D institutes, and the industry in public and private sectors.

Under a grant-in-aid project of the Department of Space, investigations have been carried out on the behaviour of buildings under acoustic loads due to satellite launch at SHAR Centre.

In the area of experimental mechanics, a project sponsored by the Research & Development Establishment (Engrs), Pune, on static and dynamic analysis of mobile platform based transporter-cum-tilter and another, sponsored by the Oil & Natural Gas Commission, Mumbai, entitled, 'Investigations on the in-service gas pipeline crossing across River Mindola for operational safety' have been completed. A new project has been taken up on investigation of main and nose under carriages of Light Combat Aircraft, under the sponsorship of the Aeronautical Development Agency, Bangalore.

In the area of computer-aided analysis, design and software development, the Centre has registered good progress. Twenty-nine software packages of the Centre have been released to various organizations in the public and private sectors. A critical review of various existing mesh partitioning algorithms was carried out in the previous year. A greedy algorithm for automatic partitioning of finite element meshes and AI_Nasra, and Nguyen algorithm (ANP) and Packing algorithms for automatic decomposition of finite element meshes, were implemented. During the year numerical studies on greedy algorithm to assess the characteristics and sensitivity of the algorithm, development of preconditioned greedy algorithm for automatic decomposition of finite element meshes, development and implementation of Recursive Coordinate Bisection algorithm (RCB), Recursive Principal Inertial (RPI), Recursive Spectral Bisection (RSB), Recursive Spectral Two-Way (RST), and Recursive Spectral Sequential - cut (RSS) algorithms for automatic partitioning of finite element meshes have been completed.

A software for knowledge-based optimization for transmission line

system has been developed. A project on non-linear dynamic analysis of concrete structures has been successfully completed. Capabilities and expertise developed in the ongoing R&D projects on adaptive refinements and parallel processing are in line with the CSIR-KFA bilateral cooperation programme. Following the successful completion of a sponsored project on development of software for the design of transmission line towers, M/s EMC, Calcutta, has now requested SERC to develop software package for generation of assembly/shop drawings and bill of materials for barrel type transmission towers, as a sponsored project. A project on 'Finite element modelling for static and dynamic analysis of stiffened plate/shell panels using h-adaptive refinement techniques', has been taken up for the Aeronautical Research and Development Board and another on 'Modelling and optimization of structural components for air vehicle system', for the Defence Research and Development Laboratory, Hyderabad. The sponsored project 'Development of interactive computer software for analysis and design of ships and ship structures' has been completed and SERC's software modules validated by the sponsor, M/s Hindustan Shipyard Ltd, Visakhapatnam. At the invitation of the International Institute of Seismology and Earthquake Engineering, Japan, a scientist from the Centre presented the country paper on 'A review of IS: 1893- 1984 Codes provisions on seismic design of buildings' in the seminar on seismology and earthquake engineering.

In the area of concrete composites and construction engineering, studies on RC beam-column joint, with steel fibres in the concrete ma-

trix at the joint, were taken up to investigate the contribution of steel fibres and concrete matrix in improving the ductility in the joint. It was found that both strength and deformation characteristics of beam-column joint improve when fibres are introduced. Also, with addition of steel fibres, the stirr-up spacing of column in the joint portion could be increased. The Centre conducted an advanced course on 'Damage Assessment and Rehabilitation of Distressed Concrete Structures' during December 1996, which was attended by 44 participants from different organizations. SERC was represented at the International Symposium on Natural Draught Cooling Towers at Kaiserslautern, Germany, where two research papers on analysis and design of cooling towers were presented. Also, Minister for Education, Housing and Works of Kerala State sought technical assistance from SERC on testing and evaluation and suggestion for remedial measures for the rehabilitation of structures, including bridges in Kerala. The Centre has been successful in developing a latex modified concrete using both natural and synthetic rubber latex.

In the area of prestressed concrete, suitable algorithms have been developed and utilized to apply decompression moment technique for determining the re-

sidual prestress in priori uninstrumented beams.

A project has been taken up to develop a disaster resistant low-rise building construction system under the sponsorship of Building Materials & Technology Promotion Council (BMTPC), New Delhi. A construction system using reinforced hollow blocks was developed and found to be relatively economical and structurally superior. Another project to evaluate design methodology and experimental validation of ferrocement understructures was taken up for Development Alternatives, New Delhi.

The computer packages during the year were released to: Gujarat Communications & Electronics Ltd, Vadodara (INFRAN); UPTRON India Ltd, Chennai (INTRAN); Orissa Construction Corpn. Ltd, Bhubaneswar (INFRAN, INTRAN,



Dr R.A. Mashelkar, Director General, CSIR, viewing the test set-up for experimental investigation of undercarriages of Light Combat Aircraft (LCA) at SERC

SPONSORED RESEARCH PROJECTS AT SERC-CHENNAI DURING 1996-97

- Interactive computer software for analysis and design of ships and ship structures (CODES-I) (Hindustan Shipyard Ltd, Visakhapatnam)
- Evaluation of TMT reinforcing bars manufactured by SAIL (Steel Authority of India Ltd, Ranchi)
- Performance evaluation of rebars for their use in structures in seismic zones (Tata Iron & Steel Company Ltd, Jamshedpur)
- Investigation of the in-service gas pipeline across river Mindola for operational safety (Oil and Natural Gas Commission, Mumbai)
- Static and dynamic analysis of mobile platform based transporter-cum-tilter [Research and Development Establishment (Engineers), Pune]
- Development of a disaster resistant low-rise building construction system and comparative studies with conventional construction system (Building Materials and Technology Promotion Council, New Delhi)
- Investigation on the suitability of square/ rectangular hollow section for the design of transmission line towers (Tata Iron & Steel Co. Ltd, Calcutta)
- Evaluation of design methodology and experimental validation of ferrocement under-structures (rafters and trusses) (Building Materials and Technology Promotion Council, New Delhi)
- Experimental investigation of main and nose under carriage of LCA (Aeronautical Development Agency, Bangalore)
- Development of software package for generation of assembly/chop drawings and bill of materials for barrel type transmission towers (Electrical Manufacturing Co. Ltd, Calcutta)
- Modelling and optimisation of structural components for air vehicle system (Defence Research & Development Laboratory, Hyderabad)

GRANT-IN-AID-PROJECTS

- Corrosion fatigue behaviour of offshore tubular joints (Department of Ocean Development, New Delhi)
- Experimental and theoretical investigations on the behaviour of buildings under acoustic loads due to satellite launch at SHAR Centre (Department of Space, Bangalore)
- Finite element modelling for static and dynamic analysis of stiffened plate/shell panels using 1_h-adaptive refinement techniques (Aeronautical Research & Development Board (ARDB), New Delhi)

RC SLABS (G), RC COLUMNS (G), RC BEAMS (G) and RC FOOTINGS (G)]; M/s Greaves Limited, Chennai (INSPACE); Shri V. Sundarajulu, Chennai [RC SLABS (G), RC COLUMNS (G), RC BEAM (G), RC FOOTINGS (G), and WINFRAN]; Regional Research Laboratory, Bhopal [RC SLABS (G), RC COLUMNS (G), RC BEAMS (G), RC FOOTINGS (G), RC STRIP FOOTINGS, RC FLAT SLABS, and WINFRAN]; Department of Space, Civil Engineering Division, Bangalore [RC STRAP FOOTINGS, RC FLAT SLABS (G), RC COMBINED FOOTINGS (G), INFOLD, INCYSHELL and RC INTZE TANK]; Technical Teachers Training Institute (TTTI), Chennai (WINFRAN); and Shri P.S.T. Varatharajan, Trichy (WINFRAN). □

Povidone Iodine Powder

THE Polymer Division of Indian Institute of Chemical Technology (IICT), Hyderabad, has developed Povidone Iodine Powder as per ISP and USP specifications. It contains 9-12% of available iodine calculated on the dry basis. It is yellowish brown amorphous powder with a slight characteristic odour. Povidone iodine is an iodophore which is used as a disinfectant and antiseptic, mainly for the treatment of contaminated wounds and in pre-operative preparation for the skin and mucous membrane as well as for the disinfection of equipment. The solution of povidone iodine gradually releases iodine to exert effect on ageing bacteria, fungi, viruses, cysts, protozoa and spores. Using this powder, two formulations have been developed for mouth wash gargle solution and antiseptic solution for the disinfection of surgical equipment. □

New Sponsored Projects/ Consultancy Assignments taken up by CECRI

THE sponsored projects/consultancy assignments taken up by the Central Electrochemical Research Institute (CECRI), Karaikudi, during May-June 1998 are as follows:

Sponsored Projects

- (i) Prefinishing of steel strips with zinc for use in audio gadgets and other applications (Department of Electronics, New Delhi, and Elin Electronics Ltd, New Delhi; Rs 1.00 million)
- (ii) Electrochemical preparation of dinitrogen pentoxide (Department of Space, Bangalore; Rs 574,000)
- (iii) Development of nickel-chromium/cadmium plating of machining steel components used in aircraft (Hindustan Aeronautics Ltd, Bangalore; Rs 400,000)
- (iv) Development of cost-effective industrial prototype BOD biosensor (Department of Electronics, New Delhi; Rs 1.40 million)
- (v) Development of high-energy density nickel-metal hydride batteries for electric vehicle (Ministry of Non-Conventional Energy Sources, New Delhi; Rs 6.305 million)
- (vi) Evaluation of and advise on the long-term corrosion control measures for missile components (DRDL, Hyderabad; Rs 500,000)

Technical Assignments

- (i) Testing of miners' cap lamp lead-acid batteries (Standard Batteries, Chennai; Rs 1.00 million)
- (ii) Testing of anodized aluminium architectural sections and testing of chromate passivated zinc coatings on m.s. sections (Department of Telecommunications, Chennai; Rs 1.80 million). □

Basic Research Highlights

INDIAN INSTITUTE OF CHEMICAL TECHNOLOGY, HYDERABAD

THE basic research activities at the Indian Institute of Chemical Technology (IICT), Hyderabad, cover a wide range of scientific disciplines in chemical, biological and engineering sciences. The emphasis is on new methods of chemical preparation, synthesis of novel molecules, catalysis, biotransformation and chemical charac-

terization. Asymmetric, stereo-selective and biochemical syntheses are the major areas of doctoral and postdoctoral research interest. The highlights of current activities are:

Foam as Reaction Medium

The IICT-CCMB joint efforts, for the first time, have led to the devel-

Technology Commercialized

Surgical Bio-adhesives

THE Indian Institute of Chemical Technology (IICT), Hyderabad, has developed two surgical adhesives namely, (1) Nectacryl — N-butyl 2-cyanoacrylate and (2) Amcrylate — Isoamyl-2-cyanoacrylate and these two products are being manufactured by M/s Nectar Laboratories Limited, Hyderabad and M/s Concord Drugs Limited, Hyderabad, respectively.

Nectacryl is a fast curing bio-adhesive and it is used in eye surgeries also. Both Nectacryl and Amcrylate are biodegradable, non-toxic, bacteriostatic and non-allergenic. Both the products can be used in endoscopic surgery for controlling and stopping the acute bleeding from ruptured veins. This special application has turned out to be a life saver for critically ill patients who are diabetic, without undergoing a major surgery. Both the products are also used in prosthodontics and orthodontic surgeries apart from oral and maxillo-facial surgeries. These are also used in liver surgery for the treatment of cirrhosis. These are being very popularly used in sutureless surgeries in hysterectomy and caesarian operations. The healing is very fast and does not leave any scar. □

opment of foam as an environment-friendly reaction medium for enzyme-mediated organic reactions. The typical example is lipase-catalyzed transformations of aliphatic acids/alcohols to corresponding esters. The specific advantages of employing foam are: reduced hydrolysis of products and absence of organic solvents. There are good prospects of applying this option for chemical synthesis.

Novel Usage of Di-Tert-Butyl Polycarbonate [DTBP]

DTBP has been successfully utilized for cyclodehydration of *n*-acyl amino acids to substituted oxazoles and enantiopure synthesis of bioactive alkyl aminobenzoxazinones which are effective protease inhibitors. Currently, DTBP is used for introduction of acid labile BOC protecting group in amino acids, peptides and proteins.

New Synthesis Route for D-O-E Segment of Vancomycin

Vancomycin is a useful antibacterial antibiotic, and currently its synthesis provides the most formidable challenge to chemists. IICT has developed a new approach towards the synthesis of D-O-E segment of Vancomycin by S_NAr macrocyclization.

Novel Synthesis Route for Mycobacterium [Gordonae Strain 990]

Mycobacterium gordonae strain 990 contains a unique oligosaccharide with branched sugar residue. IICT has developed a novel synthesis route for the terminal tetrasaccharide methyl 3-O-[3-O-methyl]-2-O (α -L-rhamnopyranosyl)-L-

rhamnopyranosyl]-2-O-[β -D-xylopyranosyl]- α -L-rhamnopyranosyl.

Chiral Template for Enantiomers

α -Amino acids are of paramount importance in asymmetric synthesis and are used extensively in both the 'chiral substrate' and 'chiral auxiliary'-based versions of stereoselective reactions. Under the research programme directed towards synthesis of enantiopure compounds of biological interest, IICT has developed methods to synthesize a number of bioactive molecules utilizing the easily available amino acids as chiral template to obtain enantiomerically pure compounds of contemporary interest.

New Asymmetric, Stereoselective and Other Synthesis Routes

New asymmetric, stereoselective and other synthesis routes have been successfully employed for the generation of following class of compounds:

- α -C-Gluco phingasine derivatives
- Callipeltose
- Sequence selective DNA binding ligands
- Oxidative cleavage of oxenes
- Macrolide polyether antibiotic sorangicin
- Silyl, allyl and MPM ethers
- Acylation of ylides
- Fumonisin β backbone [chiron approach]
- Marine oxylipins
- *n*-Methyl- α -amino acids
- Pentono-1,4-lactones

- Deacetyl anisomycin
- Cyclic dilactams
- Acyclic nitroaldehydes

New Chemical Entities

The emphasis is on novel synthetic molecules with significant biological activity for their possible applications in drugs/pharmaceuticals, agrochemicals and performance products. The efforts are being made for:

- Gonio fufurones
- Karalicin
- Epothilines/amphidinolides
- Azamacrolides [optically active]
- Lasonolide A
- Macrocyclic lactones
- Glycopeptides
- Pironetin
- Sugar aminoacids
- 2-Tetra-zolyl-3-aryl propanols

Performance Products

Biosurfactant Analogues — Biosurfactant analogues based on carbohydrates and ricinoleic acid from castor oil have been prepared and their physico-chemical properties studied. These products, which are fully biodegradable and made from renewable sources, possess very good surfactant properties.

Special Polymers — Emerging from the central idea of structure-function relationship in macromolecules, the basic research programmes are taken up with the objective of producing interpenetrating hydrogel network materials with better performance and structural flexibility in the field of polymers. These systems are now being tested as suitable matrices for the

separation of very large DNA fragments produced in course of human genome analysis.

Organometallics for NLO applications—Non-linear optical [NLO] materials, which can manipulate photonic signals through frequency doubling, phase conjugation and optical switching, find wide range of applications in optical computing and telecommunication hardware. Performance of commercially available inorganic materials need to be improved. An extensive search for new material is invoked at IICT. Basic research work has been undertaken to design and synthesize new organic/organometallic molecular materials in collaboration with University of Leuven, Belgium.

- Supported metal oxides for oxidation of 4-methyl anisole to anisaldehyde
- Novel envirocatalysts [zeolite based]

Analytical Studies

NMR studies are being made for:

- Structure, conformation and dynamics of organic and biological molecules

Mass Spectrometry studies are related to:

- New method for differentiating derivatized leucine from isoleucine

- Enantiomeric excess of L-phenyl ethylamine
- Characterization of catenans
- Identification of heterocumulenes and other elusive species in isolated gas phase

X-Ray Crystallography is being employed for studying:

- Calcium channel antagonists, steroids and complex organic molecules
- Metal binding in biological systems

□

Catalysis

Solid/Super acids for organic transformations—Eco-friendly clay catalysts have been developed to replace the conventional hazardous chemicals, such as H_2SO_4 , $AlCl_3$, etc., used in chemical processes. By taking advantage of the high surface acidity of clays, particularly acid-treated and cation-exchanged clays, a variety of reactions namely methoxy methylation, oxidation coupling, Friedel-Crafts alkylation, nitrations and acylations are being successfully carried out. For selective esterification of mono- and dicarboxylic acids, zirconia-based catalysts have been developed.

Other important basic research programmes relate to:

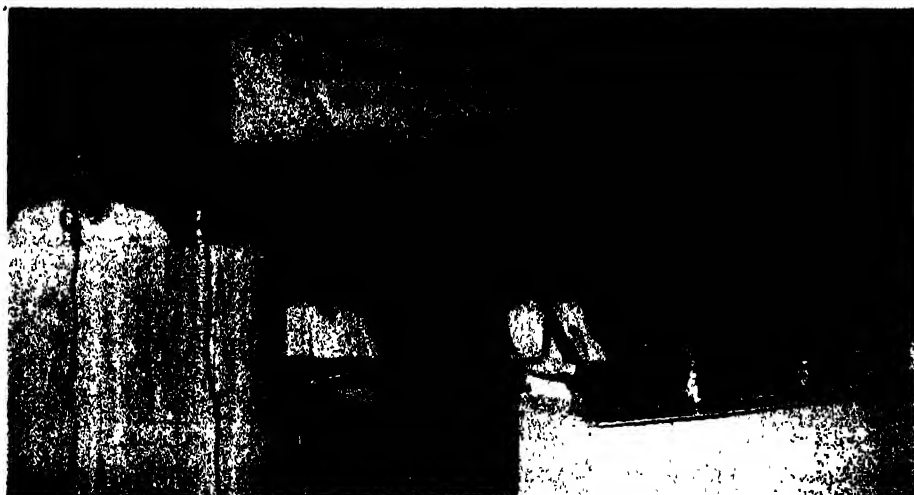
- Chiral clay catalysts for asymmetric synthesis [epoxidations and hydrogenations]
- Organotin-based catalysts for C-C bond formations in polyurethanes

CECRI completes Fifty Years

THE Central Electrochemical Research Institute (CECRI), Karaikudi, celebrated its Foundation Day on 3 August 1998. The event this year had a special significance -- it marked the completion of 50 years of the institute's existence.

Dr Placid Rodriguez, Director, Indira Gandhi Centre for Atomic Research (IGCAR) and Chairman, CECRI Research Council, delivered the Foundation Day lecture on 'Electro-

chemistry--Just Another Chemistry?' He opined that Electrochemistry could not be considered a branch of chemistry anymore because of its inter-disciplinary nature. Energy requirements in the future when the world population crosses the 10 billion mark would not be met by either the hydro or thermal units which would be in the process of getting phased out. There would be a revival of nuclear power plants and hydrogen would become the



Dr Placid Rodriguez, Director, IGCAR, Kalpakkam, delivering the CECRI Foundation Day Lecture

fuel for transportation. The automobiles would carry hydrogen cylinders instead of petrol tanks. During this period, Electrochemistry would be recognized as 'Nuclear Chemistry', he predicted.

Dr Rodriguez further said that IGCAR has plans to set up a pilot plant for direct electrorefining of irradiated fabrication fuel for reactors through a new technology being developed at the Kalpakkam unit.

Transportation and waste disposal based on electrochemistry would become universal by the middle of the next century. The growing population would put pressure on man's ingenuity on the food front. He predicted that food production would become synthetic and would supplement farm production. Dr Rodriguez foresaw carbon dioxide, now considered a waste, being converted into formaldehyde through electrochemical process, from which tasty proteins and carbohydrates would be derived. He saw a good scope for life sciences, materials science and 'real' computer science which concentrated on artificial intelligence and fuzzy logic, in the new century. The study of computer science of the future would not confine to the mere study of languages as was being done now but would focus on the creation of machines that would think and feel like human beings.

In his address, His Holiness Ponnambala Adigalar of Kundrakudi Math stressed the need for spirituality and science going hand in hand. He said real science should go towards spirituality and real spirituality towards science. He regretted that today education system was able to produce only intellectuals and not creators. The pontiff of the Kundrakudi Math urged the public to contribute their mite to the development of infrastructure in the temples of learning as if they were

temples of deities. He felt that scientific temper and outlook should not be confined to the laboratories but should go to the masses as progress would be possible only when science and technology knocked at the doors of the common man. Religion and science should go on parallel lines and technology should be channelized to solve the problems of the poor. He also called upon the media to lay more emphasis on the promotion of science and technology which was the need of the hour for a upcoming nation like India.

In his presidential address, Dr M. Raghavan, Director, CECRI, informed that CECRI would soon open a 'Window for CSIR rural technologies' at Kundrakudi. Such centres were being opened at seven places in the country under the CSIR Social and Technology Mission. Under the Clean Technology Mission, CECRI is propagating cleaner electroplating technologies in Coimbatore and Moradabad. CECRI, which is celebrating its golden jubilee year, had earned Rs 1.82 million through royalties during 1997 - 98. Also, it had undertaken work on drawing the corrosion map of the country, in collaboration with the National Corrosion Council of India. During

1997-98, seven sponsored projects worth Rs 3.917 million were completed and during the current year, 47 projects worth Rs 54.5 million are in progress. The institute is actively undertaking R&D work in all relevant areas of electrochemistry science and technology, including batteries and fuel cells, pollution control and corrosion science and engineering, he added.

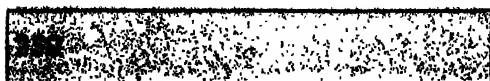
The institute, over the years, has developed 180 processes, generated 660 patents and produced talented manpower. So far, 205 sponsored projects, 73 grant-in-aid projects and 272 consultancies have been undertaken. More than 3,800 research papers have been published in national and international journals and nearly 160 staff members awarded Ph.D. degrees by various universities. CECRI was getting a 'vision paper' ready for 2005 and had a master plan to modernize its laboratories and other infrastructural facilities, Dr Raghavan added.

Shri R. Palanisamy, Scientist, read out the messages received on the occasion. Earlier, Dr R. Vijayavalli, Deputy Director, welcomed the gathering. Dr V. Krishnan, Deputy Director, proposed a vote of thanks. □

CECRI Golden Jubilee Year Seminar-cum-Workshop on Materials and Characterization

IN order to commemorate its Golden Jubilee Year and to plan for marching ahead into the 21st century, CECRI has organized several national and international seminars and conferences. The Seminar-cum-Workshop on Materials and Characterization was one such event. It was organized by the Electrochemical Materials Science Division of the Institute during 13 - 17 July 1998.

The Electrochemical Materials Science Division of CECRI, which came into existence in 1963, has carried out a significant amount of work, as a result of which five processes have been released to the industry and are in production. High efficiency luminescent materials, photoconductors, solar energy materials, conducting polymers, transport conducting oxide films, and ceramic materials are some on



which intensive R & D is being carried out in this Division.

Dr (Smt). Rukmani, Vice-Chancellor, Alagappa University, Karaikudi, while inaugurating the seminar-cum-workshop touched upon the close cooperation existing between the Alagappa University and CECRI. She also appreciated the significant contributions of the CECRI scientists in different fields of science and technology. She suggested for greater emphasis on solar energy—its preservation and storage—to augment the supply of non-conventional energy. She congratulated the CECRI Director and his team of scientists who have done an excellent job towards nation building.

Earlier, in her welcome address, Dr (Smt.) Mary Juliana Chockalingam, Deputy Director and Chairperson, presented a brief summary of the work done in the Electrochemical Materials Science Division. Shri M. Jayachandran, Scientist and Convener, gave details about the seminar-cum-workshop. He said that about 85 papers were going to be presented in oral/poster sessions. About 150 delegates, including 75 delegates representing various universities, colleges, national laboratories and other organizations, would be participating in the deliberations of the seminar and 60 delegates would attend the workshop, he said.

A booklet on abstracts of research papers on different materials was brought out. It contains 83 abstracts divided into three main sections: (i) Oxide and phosphor materials, (ii) Semiconducting materials, and (iii) Organic & conducting polymer materials. A book containing 15 lecture notes was also released. It describes fundamental concepts pertaining to methodology and practical applications of fifteen characterization techniques.

ITRC joins hands with VAM Organics

THE Industrial Toxicology Research Centre (ITRC), Lucknow, has joined hands with Vam Organic Chemicals Ltd (VOCL), Gajraula, for two projects in the area of environmental protection by signing a Memorandum of Understanding (MoU). ITRC is a pioneer research organization in the field of toxicological studies and VAM Organic Chemicals Ltd is a leading manufacturer of organic chemicals in the country. The first project relates to decolourization of treated distillery effluents for safe disposal in ecosystem, for which no easy and effective solution exists. The unknown toxic distillery effluents are not easily biodegradable and are a source of concern in the country.

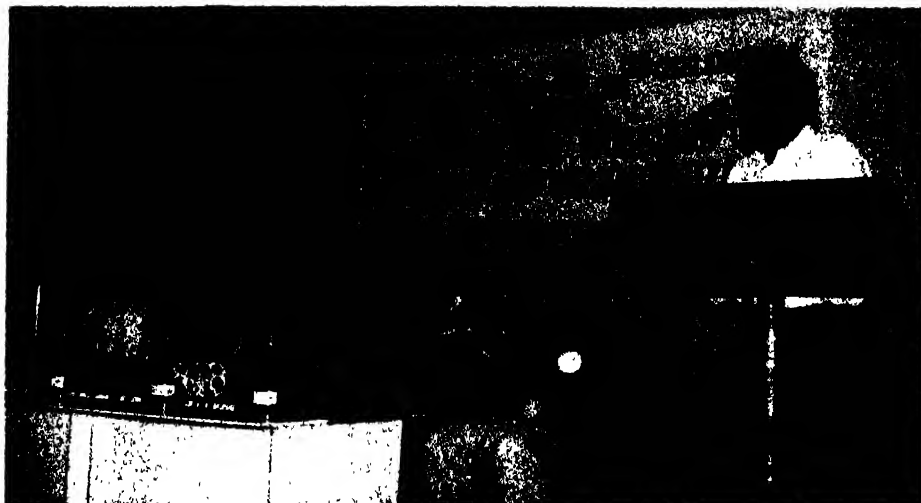
Second project is for biodegradation of effluents from other sections of chemical plant which are also very persistent in nature and may be hazardous to the receiving ecosystem.

Both projects are expected to lead to the development of new technologies which could be used for related industries all over the country, and are likely to contribute in a significant manner towards safe disposal of industrial effluents.

The MoU was signed by Dr P.K. Seth, Director, on behalf of ITRC, Lucknow and Shri S.N. Singh, President, Vam Organic Chemicals Ltd, Bhartiagram, Distt Jyotiba Phuley Nagar, U.P., on behalf of VAM Chemicals. □



During signing of MoU between ITRC and Vam Organic Chemicals Ltd, seen from left are: Shri K.N. Sharma, Dr P.K. Seth, Dr S.N. Singh, Dr P.N. Viswanathan and Shri K.K. Gupta



Dr M. Raghavan delivering presidential address at the Seminar- cum-workshop on Materials and Characterization

Dr M. Raghavan, Director, CE-CRI, in his presidential address said that solid state electrochemistry in Electrochemical Materials Science is an emerging field. One important feature of this field is its interdisciplinary nature. Advances in technology are related to the discovery and develop-

ment of newer materials. With the understanding of the principles relating their behaviour to the structure and environment, it has become possible even to predict the properties of future materials.

Dr K.R. Murali, Scientist and Convener, proposed a vote of thanks. □

TRAINING COURSES

Ventilation System for Control of Fire in Mines

THE Central Mining Research Institute (CMRI), Dhanbad, organized a five-day course on 'Pressure Balancing, Cryogenic Technology and Multizonal Ventilation System for Rapid Control of Fire and Improvement of Environment and Safety in Mines,' commencing from 20 July 1998.

Inaugurating the course, Shri P.N. Singh, Additional General Manager, TISCO, dwelt on various ventilation and fire problems of the Jharia coalfield and stressed on their prevention, control and elimination. Applauding some of the technologies developed by CMRI, like dynamic balancing of pressure, cryogenic technology and multi-zonal

ventilation system, Shri Singh stated that these technologies are showing

very good result in controlling fire in mines.

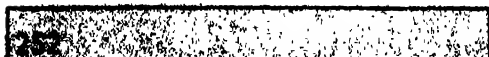
Earlier, while welcoming the guests and participants, Dr T.N. Singh, Director, CMRI, waded through the history of coal mine fire in India, particularly that of the Jharia and Raniganj coalfields. He pointed out that unscientific and uncared mining in the past was the major cause of some of the perennial mine fire problems in India.

Shri V.K. Singh, General Manager, Moonidih colliery, said, "As the mines are becoming deeper and deeper day by day, the problems of fire and ventilation are assuming critical conditions which call for suitable technologies".

He opined, "As the collieries are constrained owing to lack of funds, Government of India should finance the field trial of some of the technologies developed by CMRI, particularly those related to ventilation and fire". He also suggested that as the coal of the Jharia coalfield is very much prone to spontaneous heating, big mines should install nitrogen plant in their mines to deal with the fire in case of emergency.



Dr T. N. Singh, Director, CMRI (seated third from left) with the participants and faculty members of the course on 'Ventilation System for Control of Fire in Mines'



**Dr Lalji Singh
appointed Director of
CCMB**

DR Lalji Singh, Scientist, Gr IV(5), Central Cellular & Molecular Biology (CCMB), Hyderabad, has been appointed Director of CCMB with effect from 23 July 1998. □

Shri B.C. Bhowmick, Head, Ventilation (Special Projects) and Course Co-ordinator, explained the efficacy of dynamic balancing of pressure, cryogenic technology and multizonal ventilation system in rapid control of fire and improvement of safety and ventilation in mines.

After marathon technical classes and field visits stretching over four more days, the valedictory function was organized on 24 July 1998. On this occasion, Dr T.N. Singh assured the mining industry of all possible R&D support for making mines more productive, safe and eco-friendly. Explaining the objective of such courses he said, "This is one of the channels by which CMRI carries the R&D information from lab to the field".

Shri R.K. Paul, General Manager, HRD, BCCL, highly appreciated CMRI for developing various technologies which are effective for rapid control of fire and improvement of environment and safety in mines.

Shri Bhowmick claimed, "With the implementation of CMRI-developed pressure balancing technique and infusion of gaseous and liquid

nitrogen, fire in most of the sealed-off fire-affected areas can be controlled within a few weeks". "Thus, it would not only be possible to save coal from fire but also to the safe recovery of equipment in shortest possible time". He said that pressure balancing technique can also be ap-

plied in combination with other techniques for controlling fire in mines to enhance their effectiveness.

Shri R.P. Singh, Head, HRD and Convener of the course, proposed a vote of thanks, both at the inaugural and valedictory functions. □

OBITUARY

Dr Jyotirmoy Das

WITH deep regret CSIR News informs its readers about the sad demise of Dr Jyotirmoy Das, Director, Indian Institute of Chemical Biology, Calcutta and one of the pioneers in Molecular Biology research in this country. He died of respiratory failure and cardiac arrest on 26 July 1998 at Calcutta. He was 59 and is survived by his wife and daughter.

In his condolence message, Dr R.A. Mashelkar, Director General, CSIR, described Dr Das as a distinguished scientist with pioneering contribution to cholera research. At a meeting presided over by Dr D.K. Ganguly, Acting Director and members of the staff of IICB deeply mourned the sad and sudden demise of Dr Das.

Born on 13 September 1939, Dr Das had a brilliant academic career. After obtaining M.Sc. degree in Physics, he pursued a research career in Biophysics at the School of Tropical Medicine, Calcutta and received a Ph.D. degree from the Calcutta University in 1968. He was awarded D.Sc. degree by the Calcutta University for his outstanding work on DNA replication of Mycoplasma viruses. He worked as a post doctoral research fellow and later as Assistant Professor at the Department of Microbiology, University of Rochester, New York, until 1978 when he returned to India and



stitute. In February 1979, Dr Das joined IICB as Head of the Biophysics Division. Thereafter, his original and innovative research work distinguished him as a scientist of great acumen across the country and abroad. He was appointed Director of IICB in December 1995.

His major research interest was elucidation of the molecular basis of pathogenicity of *Vibrio cholerae*, the etiological agent of the diarrheal disease cholera. He was one of the pioneers to establish molecular biology in this country during the late seventies, and once again in the nineties he initiated pioneering work on the newly emerging areas of bacterial genome mapping and comparative genomics. For the first time in the world, he and his group

constructed a physical map of the *V. cholerae* genome which was highly acclaimed by eminent scientists all over the world.

Another of his major achievements was the development of a genetically engineered live oral cholera vaccine. The extraordinary agility and perspicuity of his brilliant mind really came to fore in the manner in which he developed a totally diverse project on Theoretical Biology and Mathematical Modelling parallel to and simultaneous with his work on *V. cholerae* genetics. He proposed a new theory of self organization in non-ideal biochemi-

cal systems and made significant contribution to the analysis of fractal patterns in macromolecular sequences.

His outstanding scientific contribution was honoured by a large number of prestigious awards, including the Ranbaxy Research Foundation Award, Om Prakash Bhasin Award and INSA Golden Jubilee Commemoration Medal. He was a Fellow of the Indian National Science Academy, Indian Academy of Sciences, and National Academy of Sciences. He was one of the founder Fellows of West Bengal Academy of Science & Technology. He

also served in an advisory capacity in many scientific governing bodies, funding agencies and research institutions. He had about 100 publications in reputed journals and guided 30 research students.

A man of long range vision, Dr Das set trends in formulating and executing research goals not only for IICB but for the entire scientific fraternity. Many would remember with affection and respect his multifaceted personality and diverse interests that included literature, philosophy, music and art. □

ADVERTISEMENTS

COUNCIL OF SCIENTIFIC AND INDUSTRIAL RESEARCH, NEW DELHI

Advertisement No. 10/98

POSITION: DIRECTOR, INDIAN INSTITUTE OF PETROLEUM (IIP), DEHRA DUN

COUNCIL of Scientific and Industrial Research (CSIR) is the premier organization established by the Government of India to undertake scientific and industrial research in the country. It has a network of 40 R&D institutions spread throughout the country, covering diverse S&T disciplines and serving a wide gamut of socio-economic sectors.

The Council is looking for a suitable scientist/technologist for the post of Director for its Indian Institute of Petroleum (IIP), Dehra Dun. IIP is situated at a picturesque location in Dehra Dun. The institute has S&T staff of 650, of which about 170 are scientists. The major R&D programmes of the institute relate to petroleum refining, petroleum products applications, chemicals/petrochemicals intermediates, catalysts and industrial and domestic combustion.

The institute has an annual budget of around Rs 20 crore, a substantial part of which is derived from contracted work and services; and boasts of alliances with some of the internationally acclaimed engineering companies, process licensors and hydrocarbon firms.

The Director is the Chief Executive of the institute and would be responsible among others for realizing IIP's mission to become a globally competitive supplier of wide range of R&D services for the hydrocarbon, petroleum, transport and allied sectors.

The candidate for the post must be creative, innovative and well-established scientist/technologist of distinction and should preferably be around 50 years of age. He should possess leadership qualities covering *inter-alia* demonstrated ability to create an environment conducive to nurturing of high class R&D talent, a

proven record of inter-personal skills and ability to communicate effectively.

This is a contractual appointment for a period of six years or up to superannuation (at the age of 60 years) whichever is earlier. The contract can be extended further in exceptional cases.

The post carries the pay scale of Rs 18,400-500-22,400 plus allowances as admissible to CSIR employees, with facility to share the monies realized from external contract R&D, consultancy and rendering of S&T services. Residential accommodation is provided as per CSIR rules.

Interested candidates may send their complete biodata by 30 September 1998 to the Director General, CSIR, Rafi Marg, New Delhi - 110 001 (FAX - 3710618; E-mail: dgcsir@csirhq.ren.nic.in). □

COUNCIL OF SCIENTIFIC AND INDUSTRIAL RESEARCH, NEW DELHI

Advertisement No. 11/98

POSITION: DIRECTOR, NATIONAL INSTITUTE OF SCIENCE, TECHNOLOGY AND DEVELOPMENT STUDIES (NISTADS), NEW DELHI

COUNCIL of Scientific and Industrial Research (CSIR) is the premier industrial R&D organization in India. It has a network of 40 R&D laboratories/institutions spread throughout the country covering diverse S&T disciplines and serving a wide range of socio-economic sectors.

The Council is seeking to appoint a Director for its unique National Institute of Science, Technology and Development Studies (NISTADS) located at New Delhi. NISTADS provides policy and analysis support to the CSIR and other national S&T systems. NISTADS is known for its studies on S&T policy; History, Philosophy and Sociology of S&T; Technology and Social Change; Resources, Planning and Utilization for Regional Development and Scientometrics. It has a

total staff of about 250 persons of whom about 60 are Scientists, and an annual budget of around Rs 5 crore.

The Director is the Chief Executive of the institute and would be responsible, among others, for realizing the institute's mission to develop as a global centre of excellence in the area of Science, Technology and Development Studies.

The candidate for the post should be preferably around 50 years of age. He/she should be a creative professional possessing high level academic credentials and wide ranging knowledge of national and international S&T systems and S&T Policy issues and proven managerial capability.

This is a contractual appointment for a period of six years or up to the age of superannuation at the age of 60 years, whichever is earlier. The contract can be extended in exceptional cases. The post carries a salary scale of Rs 18,400-500-22,400 (revision under consideration) plus allowances as admissible to CSIR employees, with facility to share the monies realized from external contract R&D, consultancy and rendering of S&T services. Residential accommodation is provided as per CSIR rules.

Nomination for the post should reach to the Director General, Council of Scientific & Industrial Research, Anusandhan Bhawan, Rafi Marg, New Delhi 110001, Fax.011-3710618, E-mail: dgcsir@csirhq.ren.nic.in by 30 September 1998. ☐

ANNOUNCEMENTS

Industry-oriented Technology Courses at CECRI

THE Central Electrochemical Research Institute (CECRI), Karaikudi, will be conducting the industry-oriented technology courses in the following subjects during August 1998- March 1999:

1. Chlor-Alkali Technology
2. Instrumental Methods of Analysis
3. Pollution Control and Monitoring (2 modules)
4. Water Treatment Technology
5. Information Technology (IT) for Libraries
6. Micro CDS/ISIS Library and Information Retrieval Applications
7. Storage Batteries
8. Lead Acid Battery Technology (2 modules)
9. Corrosion Science & Engineering (10 modules)
10. Industrial Metal Finishing (7 modules)

The courses are structured as modules, each lasting for 5 to 6 days.

Interested candidates can register for as many modules as they desire. Course fee varies between Rs 750 and Rs 3000 per module. For further information please contact: The Director, CECRI, Karaikudi 630 006, Tamil Nadu. ☐

Sixteenth International CODATA Conference

THE ICSU Committee on Data for Science and Technology will hold its 16th International Conference as well as General Assembly in New Delhi in November 1998. The conference is being sponsored by CSIR, INSA, DST and DRDO. In addition, DBT and AICTE are also likely to sponsor the conference. This series of conferences provide a forum for interaction and information transfer between leading scientists and engineers from different disciplines of science and technology who are engaged in data generation, evaluation, dissemination and applications. The fast changing scenario in information generation and management technology particularly in networking at national and global level necessitates frequent review of the state-of-the-art and discussion on trends and important aspects of the field. This modern technology has a vital role to play in sustainable development of society in general.

The conference will have presentations from leading scientists reviewing state-of-the-art and their vision for future. Active researchers will have opportunities to share their research results.

The following topics will be covered:

- Astronomical Data: Problems & Prospects
- Integrated Materials and Chemistry Data Systems
- IPR Issues in Databases and Software
- Hydrology, Land Degradation, Seismology
- Thermodynamic Data
- Heterogeneous Data Framework of Industry--Economic, Legal and Engineering Data

- Rice Cultivation - The Need for Interdisciplinary Data
- Biodiversity
- Bioinformatics and Medical Informatics
- Data Dissemination through Information Highways
- Derived Data
- Issues and Usefulness of Data using Remote Sensing Metrology
- Data Mining and Knowledge Discovery in Databases

The technical sessions will have invited lectures by leading scientists to review current status and trends; Short oral presentations by selected young scientists; and Poster sessions for contributed papers.

Registration fee for delegates is US \$ 350 before 1 October 1998 and US \$ 400 after 1st October 1998, for Research Scholars fee is US \$ 175 before 1 October and US \$ 200 after 1 October.

For further details please contact:

Dr Krishan Lal, Chairman,
LOC. CODATA'98,
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+91-11-5754891 (Res.),
E-mail klcodata@nde.vsnl.net.in, or
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National Physical Laboratory,
K.S. Krishnan Road,
New Delhi-110012, India
Telegram: NATPHYLAB,
NEW DELHI,
Fax: +91-11-5752678 & 5764189

Satellite Meeting

A Satellite Meeting comprising a one-day Study Workshop/Tutorial is also going to be held (7 November 1998) on 'Information Visualization and Management of Heterogeneous Systems'.

Increasing amounts of data and information and the availability of fast digital network access (e.g. the World Wide Web) have created a demand for querying, accessing, and retrieving information and data. There are however some road blocks to the success of the information highway. They include: Effective visualization which enables users to use the information highway easily and efficiently, and Adequate information management which supports access and retrieval for distributed and heterogeneous data sources. The thrust of this study workshop will be to demonstrate the state-of-the-art of these important fields and to define future directions for research and development and for real-world implementation.

The proposed one day event will synergize academia and industry bringing people from diverse research and development and application areas.

The registration fee for foreign participants is US \$ 80 and for Indian participants Rs 2000.

For further information please contact:

Prof. N. Balakrishnan, Chairman, Supercomputer Education and Research Centre, Indian Institute of Science, Bangalore, 560 012. Tel: +91 80 3346325, Fax: +91:80 3346648, E-mail: balki@aero.iisc.ernet.in □

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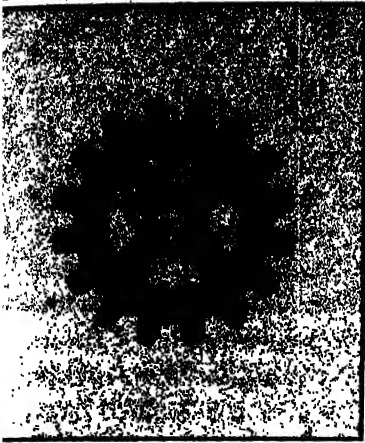
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CSIR NEWS

Weather Modelling and Prediction made Quick and Easy

ABOUT five years ago, Dr P. Rama Rao, who was then Secretary, Department of Science and Technology (DST), invited all the major Indian R&D teams involved in parallel processing to take a crack at a very big problem: To study the Global Circulation Model (GCM) T-80 weather prediction code, to port this code on their parallel computer and to validate their results with those obtained on the Cray XMP computer available at the National Centre for Medium Range Weather Forecasts (NCMRWF) at New Delhi.

The National Aerospace Laboratories (NAL), Bangalore's Flosolver Lab was one of the participants in what was truly quite a remarkable national experiment. For many weeks and months, Dr U.N. Sinha and his team at NAL laboured to execute this code even in the sequential mode. Reason: the 40,000 line code contained a large number of Cray-specific calls — because either one sincerely believed then that only a supercomputer with 'Cray power' could ever run this code, or one wanted to ensure that

this code could only be run on a Cray; which also made a good commercial sense.

Dr Sinha now recalls that porting the sequential code on NAL's Flosolver Mk3 proved to be more difficult than 'parallelizing' the code (which approximately means: break up the computation so that the first processor handles calculations along the first prescribed latitude range, simultaneously, the second processor works along the second prescribed latitude range, etc; initially the parallelization was done over four processors). About 9-12 months after the experiment began, NAL was the first to publish its finding that, on the 4-processor Flosolver Mk3, a 24-hour forecast could be made in about 90-100 minutes (NCMRWF's 2-processor Cray could do it in 15 minutes).

Then followed the challenging ordeal of proving that NAL's computations matched those on the Cray. Generally speaking the agreement was excellent; but there were kinks, glitches and apprehensions. At times it even seemed that Indian teams could almost not believe that the computations could be success-

fully replicated on a non-Cray platform. The net result was that Dr Sinha's team had to look even harder at each of the 40,000 lines of code, and undertake some unusual experiments, to convince everyone that the game had indeed been won.

While the task of 'deciphering' 40,000 lines of cruel code (it wasn't easy, essentially because different teams had written different lines of the code in different styles and the 'bonding' was rather tenuous) appeared to be a severe punishment then, it really proved to be the precursor to the success which is being reported today.

The more Dr Sinha looked at the 40,000 line code, the more he was convinced that the code could (and should) be completely re-engineered. Why, for instance, should the code be so Cray-dependent? Why, again, should it be only an '80-mode' code? And, finally, why was it that the internal algorithms of the code made it so difficult to get a real parallelization speed-up when the number of processors exceeded four?

A gift of a laptop computer from one of his admirer students who landed a plum 'job' in Singapore proved to be the serendipitous trigger. Taking the laptop home, Dr Sinha commenced the arduous task of software re-engineering. He looked at the most clumsy subroutines first and started rewriting them. "The variables were all over the place and there were a large number of unnecessary calls", he now recalls. Looking at the code, it wasn't at all easy to deduce the underlying mathematical equations. So Flosolver Lab started preparing little booklets in the 'then and now' format (which listed the original code, the deduced--and often simplified--underlying mathematical equations and the re-engineered code). And the 18-month hard and dedicated work led to two happy endings. First, the 40,000 lines were whittled down to 18,000 lines and it was established that the engineered code could indeed compute in any mode (not only the 80-mode; in fact at the function, held on 14 August 1998 to publicly announce the NAL breakthrough, Dr Sinha invited Prof. Sulochana Gadgil, and Prof. J. Srinivasan of CAOS "to choose any mode"). Second, and this was really the icing on the cake, it was discovered that the re-engineered code could be easily ported on a Pentium-II PC and that it took just 60 minutes to make a 24-hour forecast using the 80-mode calculation in the sequential mode; when parallelized to run, e.g. on four Pentium-II processors, the forecast could even be made in a quarter of an hour.

The implications of this breakthrough are exciting and fascinating to contemplate. First, as Prof. Narasimha pointed out, this success means that research on weather modelling and prediction is now "possible virtually anywhere" in the country (even a university with a

very modest budget can now buy a Pentium-II for less than Rs 50,000 and get started). Second, and this point was made both by Prof. Narasimha and Prof. Gadgil, it is now possible to "play endlessly with the physics" of weather prediction once one has the required data. Finally, the re-engineered code offers India a real opportunity to study the behaviour of the monsoon (which is a sub-continental phenomenon and therefore of greatest interest to us; especially because every existing weather prediction code is known to predict the monsoon differently!), the dynamics of the tropics (it is widely believed that weather predictions for this region must consider the Coriolis factor, largely

ignored by existing weather codes whose 'market' is really the temperate region) and make more focused regional forecasts (e.g. computations in higher modes to more accurately spot cyclones).

It was therefore a delighted audience which joined Dr T. S. Prahlaad, Director, NAL, in applauding the fine achievement of the Flosolver Lab recently. Characteristically modest, Dr Sinha offered his latest success as a 'belated birthday gift' to his mentor, Prof. Narasimha. Dr P. Rama Rao too must be delighted. His daring technological challenge could well lead to a tremendously valuable national pay-off. □

Daylight and Solar Irradiance Parameters for Improved Daylighting of Buildings

THE International Commission on Illumination (CIE) and World Meteorological Organisation (WMO) have launched the International Daylight Measurement Programme (IDPM) in which 20 countries are participating. The daylight measurement programme in India has been taken up by the Central Building Research Institute (CBRI), Roorkee, in collaboration with DST, MNES and ISLE.

Daylight pertaining to the visible region between 400-700 nm constitutes approximately 50% of total solar energy and has significant application in daylighting of buildings, integration of daylighting and artificial lighting, solar passive architecture, energy conservation in buildings, operation of photo control devices, photo conversion and tunnel lighting. At present, these data are not available.

As per the CIE requirements, a research-class daylight measurement facility in the CBRI's premises

and five general class facilities have been established at five different stations, viz. Gwalpahari (Delhi), Indore, Udaipur, Mussoorie and Thiruvananthapuram. Two more general class daylight measurement stations are to be established at Pune and Calcutta shortly.

The parameters being measured for obtaining the daylight availability at different latitudes and climates in the country are:

- Diffuse illumination and irradiance
- Global illumination and irradiance
- Vertical illuminance
- Zenith luminance
- Sun shine duration

In addition, sun tracking precision pyrheliometers have also been installed for measurements of direct beam illuminance and irradiance at Gwalpahari, Indore and CBRI. The

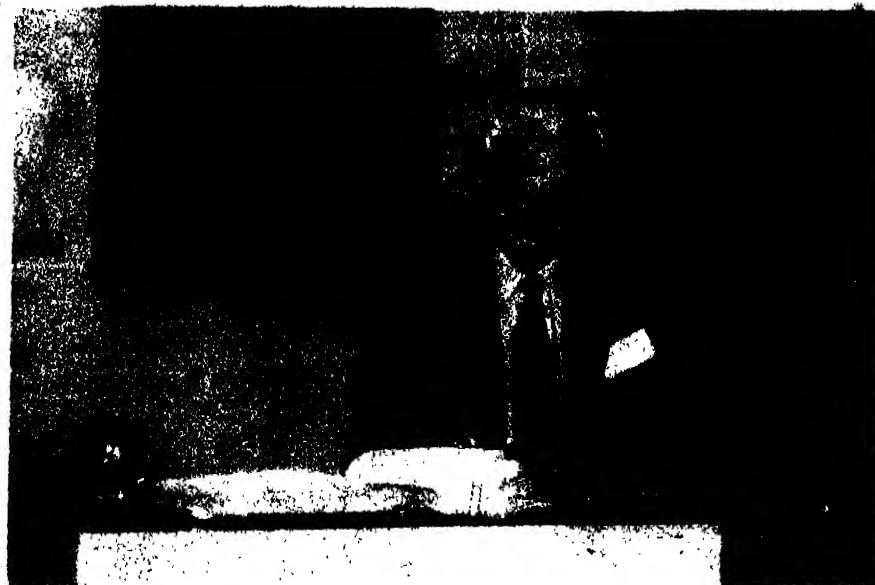
additional facilities for automatic scanning of sky luminance distribution, spectral energy distribution and sun photometric measurements for characterization of atmospheric conditions have also been provided at the institute. The Data Acquisition System (DAS) for measurement of the above daylight parameters are fully automatic, and have been provided with autoscan and timer for scanning and storing of data at desired intervals within preset daylight hours.

The measured daylight parameters have been analyzed for utilization of northlight and for evaluating luminous efficacy of solar and sky radiations for converting available solar irradiance data into daylight availability values for latitudes not covered under the IDPM project.

In tropics, north light forms a desirable diffused source for daylighting of industrial, educational and office buildings, especially at latitudes north of Tropic of Cancer. Sun path for these latitudes is such that it causes almost nil or very little direct solar insolation on north facade, limited only to morning and evening hours of the day. For facilitating computation for utilization of north light, the sky luminance of north sky has been evaluated at 45° from horizon alongwith simultaneous evaluation of zenith luminance, horizontal sky illuminance and global illuminance.

The luminous efficacies for clear and cloudy sky and global radiation have been found to be 120-140, 105-120 and 95-115 lm/w respectively. The day light availability values for hot dry climate have been found to be considerably higher than those for composite climate. This also has to be taken into account for daylighting design computations. □

Dr R.A. Mashelkar inducted as Fellow of Royal Society, London



Top: Prof. Aaron Klug, Nobel Laureate and President of the Royal Society, inducting Dr R.A. Mashelkar, Director General, CSIR, as Fellow of the Royal Society on 17 July 1988, at the premises of the Royal Society, London, as Prof. J. Rowlinson, FRS, Secretary, Physical Sciences, looks on.

Above: Dr Mashelkar signing in the prestigious 'Fellows Book' in which the Fellows of the Royal Society have been signing since 1688. The Book contains the signatures of the giants in science such as Isaac Newton, Rutherford, etc. □

INSTITUTE OF HIMALAYAN BIORESOURCE TECHNOLOGY, PALAMPUR

LOCATED in the lap of rich biodiversity, the Institute of Himalayan Bioresource Technology (IHBT), Palampur, carries out Research & Development activities aimed at conservation and use of biosources of the region in a sustainable manner. The institute was accorded national identity by giving it the present name in January 1997, earlier it was known as CSIR Complex, Palampur.

The institute moved to its new laboratory blocks in July 1996, and is now well equipped with state-of-the-art facilities for tissue culture, plant molecular biology, virology, plant pathology and floriculture. Its herbal garden has over 150 plant species; Many of these have been collected from interior regions of Lahaul and Spiti at 4000-5000 above m.s.l. With its R&D programmes grouped under: Hill Area Tea Science, Natural Plant Products, Floriculture, Biotechnology and Biodiversity, it has developed propagation technologies for several selected species like *Valeriana*, *Podophyllum*, *Picrorhiza*, and *Rumex* for their cultivation as economic crops. Improved strains of Damask rose and wild marigold are in advanced stage of field testing. Many of the institute's programmes are sponsored/supported by DST, DBT, APEDA, Tea Board and some private organizations. The External Cash Flow (ECF) of the institute during 1996-97 amounted to Rs 4.221 million and the revenue generated from the sale of lab products Rs 0.472 million. The total financial outlay for the year was Rs 35.97 million.

Some of the major activities during 1996-97 under the various areas were:

Hill Area Tea Science

Six yield-evaluation trials are being carried out. UPASI-9, TV-19, TRI-2025, Tukdah-78 and BS-65 have been found to be promising clones and ST-449, a biclinal seed stock.

Three biclinal seed stocks released by TRA were procured. Plantation of parents of TS-569 was done for establishing the *seedbari*.

Out of 216 single bush selections made at the farmers' fields during October 1995 to October 1996, 58 were selected for propagation and subsequent evaluation.

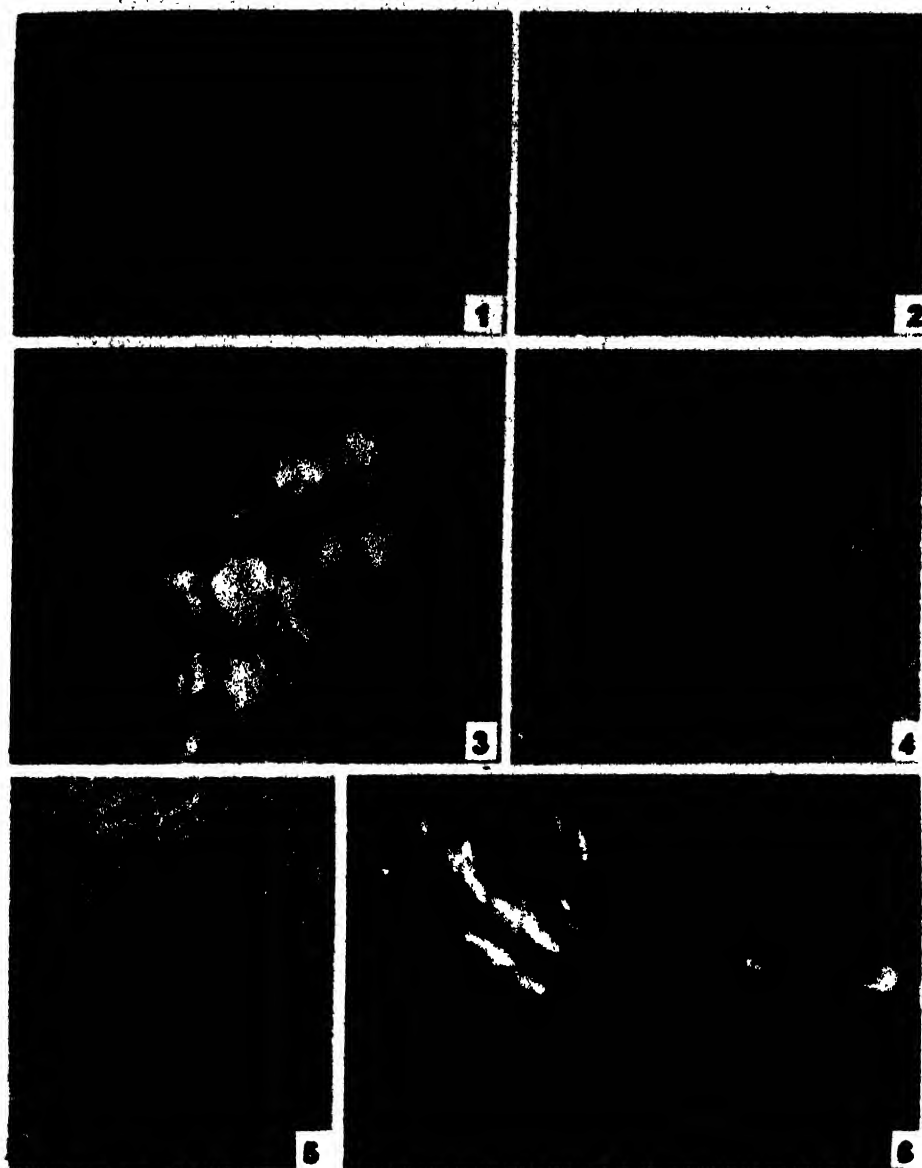
In a section specifically planted for investigation on tea leaf harvesting with machines, the green leaf yield from double hedge dome-

shaped plucking table under machine-harvesting was found to be 51.62% more than yield from double hedge flat-shaped plucking table under hand-plucking. The increase in yield from dome-shaped table has been attributed to larger plucking surface than flat-shaped table. The quality of leaf harvested by machine with curved blades, suitable for dome-shaped table, was found to be better than the machine with flat blades which induced more cut leaf. This was due to inability to cover the total plucking table by the flat shaped machine. An experiment was initiated to evaluate these machines in conventionally planted mature tea section.

Field inoculations of tea clones on tender shoots with blister blight populations showed highest disease response in Asha KVK-1, Panitola, Bannockburn-157, Sundram (UPASI-3), and Jwala KVK-3, followed by Tukdah-383, Tukdah-



Double hedge dome and flat-shaped plucking tables for machine harvesting of tea leaves



1. Shoots of Panitola and 2. Banuri Selection-26 of tea inoculated with *Exobasidium vexans*; 3. Whole leaf mount and 4. Transverse Section of leaf showing heavy fungal infestation in Asha KVK-1; 5. Whole leaf-mount showing resistance response in UPASI-10; and 6. Blister development incited by single spore inoculation in Asha KVK-1

253, UPASI-9, TV-19, Tukdah-78, AV-2, Phoobsering-312, and Banuri Selection-26. Lowest disease response was obtained in TRI-2025, UPASI-10, and SA-6. Different disease response against pathogen populations included slight disease development with low sporulation against Chogan population and moderate disease response sporulation against Chambi population in SA-6, and no disease development

against Odder population in Banuri Selection-26. Similar clonal disease response was also recorded under controlled lab conditions (growth chamber).

Observations on infection process in susceptible and resistant tea-blister blight pathogen interactions revealed markedly higher spore germination and appressorium production in Asha KVK-1 than SA-6 within

3 days of inoculations. Following six days of inoculations, no penetrations and leaf-tissue colonization were observed, and germ tubes and appressoria appeared shrivelled in SA-6, while Asha KVK-1 showed extensive colonization of leaf-pallisade and rupturing of overlying epidermal layer. Development of mature basidia, sterigmata and basidiospores was recorded within 8-10 days of inoculations. Elicitation induced extensive browning and necrotization of leaf tissue in UPASI-10.

Work was initiated on isolation, inoculation, and disease development by single spores on cut shoot cultures and rooted stem cuttings to raise single spore isolates of blister blight pathogen populations from different tea growing areas.

Arbuscular mycorrhizal fungi (AMF) analysis of rhizospheric tea soil showed *Glomus* to be the dominant genus, followed by *Gigaspora*. Histological studies were further carried on AMF colonized roots. Multiplication of AMF was undertaken in association with maize plants in pot cultures.

Based on the method standardized in the laboratory, black tea (total 240 kg) was manufactured in a commercial factory on two successive days and the graded tea samples were assessed by commercial tea tasters. The teas were well received in the auctions and fetched Rs 170 per kg.

Natural Plant Products

Variation in the essential oil composition of *Tagetes minuta* (leaves, flowers and whole plant) with respect to major constituents was observed during June-December 1996. The oil distilled from June to August contained major amounts

of dihydrotageton and Z- and E-tageton. The highest amount of dihydrotageton was present in leaf oil. Flower oil was rich in ocimene and E-ocimenone. The whole plant oil (December) contained major amount of monoterpene hydrocarbon ocimene. A comparative study was also carried out on the essential oil composition of winter, autumn and regenerated crops distilled in January. The winter crop contained major amount of ocimene followed by dihydrotageton. The regenerated crop had major amount of ocimene followed by E-ocimenone, while autumn crop had major amount of E-ocimenone followed by ocimene. E-ocimenone, which has larvicidal activity, was a major constituent in oil of autumn crop as compared to winter and regenerated crops. These studies will help the industry produce *T. minuta* oil of desired composition.

Studies were also made on the concrete and absolute of *T. minuta* which have not so far been explored by the perfumery industry. The absolute of whole herb, flowers and leaves had different composition with respect to major constituents. E-ocimenone was 38.03% in the whole herb absolute, 23.4% in flower absolute and only 1.28% in leaf absolute. Being rich in ocimenones, flower and leaf absolute hold good scope in the perfumery industry.

Samples of bark and needles of *Taxus wallichiana* collected from Triund, Dharamshala (2700m) were analyzed by HPLC for taxol and cephalomanine content. The bark samples contained 0.001-0.033 taxol and 0.00002-0.0015 cephalomanine and the needles contained 0.00014-0.032 taxol and 0.003-0.007 cephalomanine. Also, 24 samples of bark and needles from



Improved rose oil distillation unit designed and installed at IHBT, Palampur, with in-built cohobation column

marked trees of Banjar forest in Kullu were collected during October 1996, dried at low temperature, milled and extracts prepared. The estimation of taxol, cephalomanine, baccatin-III and 10-deacetyl baccatin-III from these samples by HPLC is presently in progress.

Valepotraites from *Valeriana wallichii* are known to be used as sedatives. *V. wallichii* collected from wild sources was cultivated for evaluation of valepotraites. The roots of the cultivated material were found to contain 4.5% of valepotraites, whereas the percentage of the same is reported to be only 3.0% from wild sources.

For plant improvement, 40 plants of *Artemisia annua* were selected on the basis of growth behaviour. The samples were analyzed for artemisinin content which was found to vary between 0.02 to 0.37%.

Damask rose germplasm, collected from different parts of northern India, is being maintained. It also contains germplasm of other

rose species, viz. *R. bourboniana*, *R. alba*, *R. moschata*, and *R. multiflora*, for evaluation of their oils.

Mother stock population of Type-I and Type-II Damask rose selection was established separately for raising true to type planting material. Yield performance of a selected clone was promising, which was further multiplied and transplanted in 0.5 ha area. Besides, 24 clonal populations are under evaluation.

A solvent extraction unit with holding capacity of 3q was designed and installed at the institute farm for the extraction of selected medicinal and aromatic plants on large scale. Two hundred and eighty-two kg of rose flowers were extracted with hexane in this unit during 1996 and 987 g of concrete produced.

Floriculture

Under a project sponsored by APEDA, Government of India, ten cvs. of Asiatic hybrid lilies were collected from The Netherlands, with a



At the wild rose collection of IHBT, Palampur, blooming *Rosa moschata*, *R. brunonii* and *R. cathayensis*

view to initiating work on post-harvest technologies for cut flowers.

Twelve selections belonging to four categories of gladiolus were found to be suitable for release. Multiplication of the plant materials of the above selected type was initiated.

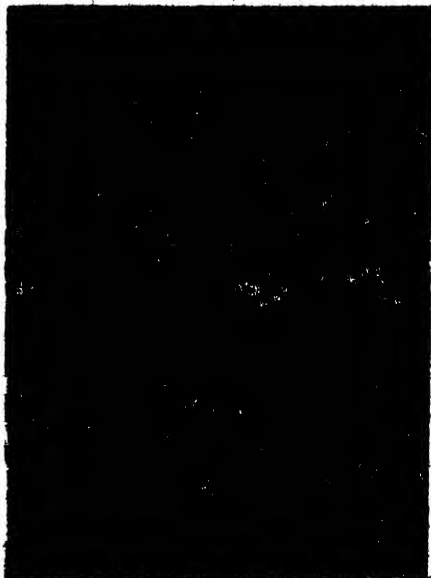
To study the compatibility factor of the wild roses as rootstocks with the scion, three types of propagation methods, i.e. stenting, cleft grafting and budding were tried on 21 strains of wild rose rootstocks.

Breeding and domestication studies were continued on tulip, gladiolus, chrysanthemum, tiger lily, bird of paradise, etc.

In vitro virus therapy was conducted in tulip, Asiatic lily, carnation, chrysanthemum and gladiolus. Explants like half bulb scales and flower stalk from 8 cvs. of tulip produced microbulbs. Similarly, small plantlets were regenerated from immature leaves and young scales of 4 cvs. of Asiatic lilies. Shoot formation was achieved from meristem tips and nodal segments of Bronze Mundial variety of chrysanthemum

and Orange Triumph, Jose and Espana varieties of carnation. Cormel segments were used in gladiolus varieties, viz. Vink's Glbry, Victor Borge, Jessica, White Prosperity, Ballerina, Friendship, Eurovision Elite and Peter Pears. For Asiatic lily, chrysanthemum, carnation and gladiolus, MS (1962) medium was used, while Riviere and Muller (1979) medium was used for tulips. Media were supplemented with plant growth regulators and antiviral chemicals. Regenerated plantlets were indexed for viruses.

ELISA indexing was carried for rose mosaic virus on 19 cvs. of roses. Rosaceous weeds like *Rubus*



Chrysanthemum selections raised by IHBT (top); and Asiatic hybrid lily in bloom (above)

ellipticus and 21 strains/germplasm of naturally occurring roses were also indexed for viruses. *Muhlenbachia platyclata* and begonia have been recorded as potential reservoir of cucumber mosaic virus. Counter immunoelectrophoresis was used for strain identification.

The institute is pursuing a DST-sponsored project on viruses of ornamental plant identification, culture collection and phyto-viroinformatics.

Biotechnology

Over the years, tea micropropagation has gained intense attention. The clones Tukdah-78, Phoobsering-312, UPASI-9 and Banuri Stock are being maintained along with multiple shoots of some biclonal hybrids. Studies made on the use of Thidiazuron (TDZ) on *in vitro* morphogenesis with Banuri Stock showed that while 1-100 nM concentration of TDZ induced multiple shoot proliferation in 40-57% explants within 8-12 weeks, all other concentrations of TDZ induced callus formation. The number of shoots developed on TDZ containing medium increased five fold when transferred to hormone-free medium. This cytokinin-like compound was observed to be relatively efficient over BAP for the induction of multiple shoots in tea.

Experiments on rooting and hardening of micropropagated tea shoots were extended to a pilot scale level. Field chambers were designed and fabricated on the basis of the lab scale model tested earlier. Plants have been transferred to field conditions for further testing.

DNA fingerprinting of tea is being carried out under a collaborative effort between HATS and Biotechnology divisions. Out of 40 diverse cultivars selected for DNA fingerprinting analysis work, 16 were initially analyzed with 3 E-series primers obtained from M/s Operon Technologies, USA.

The bamboo species presently being maintained by the institute are: In nursery — *Dendrocalamus brandisii*, *D. hamiltonii*, *D. hookeri*, *D. membranaceus*, *D. strictus*,

Bambusa arundinacea, *B. multiplex*, *B. tulda*, *Phyllostachys aurea*, *Phyllostachys* sp.; In pots — *D. brandisii*, *D. hamiltonii*, *B. multiplex*, *P. aurea*, *Thyrsostachys siamensis*; and those being grown *in vitro* and ready for field transfer — *D. hamiltonii*, *D. hookeri*, *B. arundinacea*.

A practical protocol has been developed and tested for application of micropropagation and field transfer of *D. hamiltonii*. An important development in establishing the



Some ornamentals in tissue culture:

1. *Phyllodendron* var. Green Emperor;
2. *Adiantum* sp.
3. *Pteris* sp.;
4. *Cymbidium gigantum* and
5. *Oncidium* hybrid



protocols of this species were the elimination of the shakers for multiple shoot and root induction. Thus, reducing the overall cost of production and making the protocol commercially viable.

Orchid germplasm collection and raising asymbiotic cultures using seeds were vigorously pursued during the year. Eight additional accessions were maintained in polytunnels and some of them were also brought in culture. Young plantlets from *in vitro* cultures of *Cymbidium giganteum*, *Coelogyne* sp., *Rhynchostylis retusa*, *Dendrobium nobile*, and *Oncidium* hybrid have been established in pots under foggers. Steps were initiated to procure known varieties of dendrobies and cymbidiums for the orchidarium and work will now focus on established varieties in demand.

Aseptic cultures of three varieties of philodendrons, viz. Pink Prince, Royal Queen, and Green Emperor are being maintained in the lab and plantlets being regularly put out for hardening in pots. The philodendrons have generated much interest among the hobbyists and nurserymen and many plants have been sold in pots.

The ferns have been used variously for interior decorations and as fillers in the flower arrangements. Aseptic cultures of six exotic fern species belonging to genera *Pteris*, *Asplenium*, *Adiantum*, *Polystachys* and two unidentified ferns including one tree fern, were established. Protocols for their mass propagation and establishment in soil were developed. These ferns are in demand and being sold as novelty item through exhibition sales in Chandigarh.

Detailed studies on various physiological and biochemical parameters were initiated in two different varieties of *R. damascena* Mill. namely Type-I (late flowering) and Type-II (early flowering) from the time of flowering to senescence and also during post-harvest. Studies are in progress to record changes in fresh weight, dry weight, moisture content, anthocyanin content, leakage of electrolytes, RNA and proteins in petals of both the varieties from the time of half flower opening to full bloom.

Experiments on protoplast culture were initiated with a view to obtaining somatic hybrids in *R. damascena* for increasing the time span of flowering. Different plant parts viz., stem and leaf segments of *R. damascena* and *R. bourboniana* were inoculated on MS medium supplemented with PGRs. Studies are underway to standardize media for callus induction, maintenance of suspension cultures and subsequent regeneration from callus and cell suspensions of both the species. The suspension cultures were used as a source of protoplast isolation.

By assessing the effect of various physico-chemical factors on gladiolus, conclusions were drawn regarding incubating temperature, culture vessel, growth regulator regimes suitable for increased size of cormels and the role of growth inhibitors. Some cost-effective measures were also taken in formulating the culture medium.

Work was initiated on developing technology for organelle transformation so as to use these organelles for efficient expression of genes of commercial value. An expression vector was constructed, which contained a reporter gene *gusA* and a selectable marker *aadA*

which encodes for spectinomycin resistance. A simple colorimetric one-step procedure was developed to clone *gusA* gene in a GUS positive *E. coli*.

Various parameters including choice of host, time of incubation, growth medium, etc. were standardized to widen the difference of the blue colour intensity between GUS positive and negative clones. It was possible to take this difference as a marker for identification of the clones directly on a LB agar plate. This procedure was employed in the cloning of *gusA* gene under chloroplast 16srRNA gene promoter in a plasmid pBluescriptSK+. The entire cassette containing both the genes was flanked by homologous sequences of tobacco. The above chloroplast transformation vector was bombarded into tobacco leaves using biolistic gun at Biotechnology Centre, IARI, New Delhi. Preliminary results indicate the presence of *gus* activity in portion of tissues. Experiments on the induction of stable chloroplast transformations of tobacco as a model system via DNA uptake to protoplasts is in progress. A protocol has been standardized to isolate the chloroplast DNA from *Viola* species.

Biodiversity

Surveys were conducted to locate, identify, collect and assess the natural plant resources in Dhauladhar, Uhl valley, Ravi valley, Changer forest, Marhi, Rohtang, Losar, Rong-Tong and Seraj valley. Ethnobotanical data were collected from *Gaddis* and *Bhotia* tribes in Kangra and Lahaul-Spiti districts during field surveys. Plants used as supplement food and for medicinal purpose were identified. Information on more than 40 plants, includ-

ing the target species, were gathered from these inhabitants, in addition to details on their food habits and traditional methods for conserving plant genetic resources.

Some of the important species maintained in the institute's herbal garden are those of *Artemisia*, *Berberis*, *Centella*, *Dactylorhiza*, *Dioscorea*, *Geranium*, *Hedychium*, *Heracleum*, *Hippophae*, *Hypericum*, *Jurinea*, *Origanum*, *Picrorhiza*, *Plantago*, *Podophyllum*, *Rhododendron*, *Rumex*, *Selinum*, *Senecio*, *Silybum*, *Thymus*, *Tragopogon*, *Valeriana*, *Viola* and *Zanthoxylum*.

In situ leaf gas exchange parameters were studied in case of *Hippophae* at different altitudes, alongwith several representative species in alpine and temperate zones. CO₂ gas response curves and variations in conductance and inter-cellular CO₂ levels were recorded at different elevations.

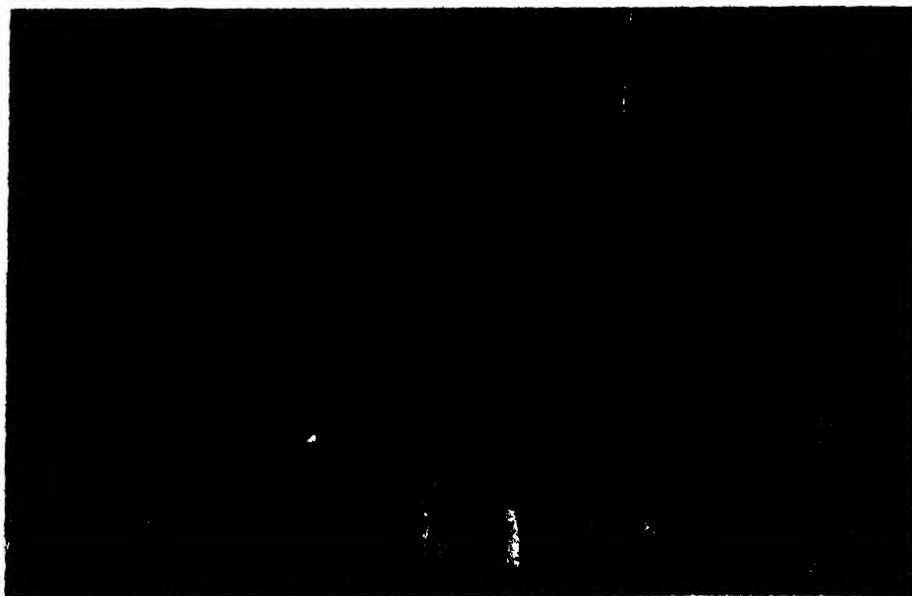
Morphological studies, including variation in stomatal density and stomatal number, were carried out in *Valeriana*, *Podophyllum*, *Hippophae* and other species of the area.

Studies on development of agro-technology for propagation and husbandry of some target species, viz. *Artemisia* spp., *Valeriana wallichii* Jones are in progress.

Eleven species of *Artemisia* were collected and planted in field for propagation. Rooted plantlets and seeds of two species of *Hippophae* were also collected and transferred to field for assessment of their acclimatization, establishment and subsequent growth behaviour.

Stem cuttings of *Hippophae*, *Taxus wallichiana* collected from Seraj valley of Kullu and leaf explants and single node cuttings of *Picrorhiza* were treated with different concentrations of PGRs and planted under poly-tunnels for their rooting performance.

Genomic DNA from eight *Artemisia* and four *Valeriana* accessions was isolated after standardization of parameters for isolation of DNA in pure form. Various PCR parameters were standardized for obtaining successful RAPD fingerprinting. Using 10 mer primer from Operon technologies (Kit E) RAPD patterns were obtained



Taxus wallichiana in Seraj valley of Kullu

CMRI signs MoUs with MECL & ONGC

A Memorandum of Understanding (MoU) has been recently signed between the Central Mining Research Institute (CMRI), Dhanbad and the Mineral Exploration Corporation Limited (MECL), Nagpur, for taking up collaborative ventures on mining, civil and environmental engineering, and related fields in India and abroad.

According to a second MoU, signed with Oil & Natural Gas Corporation (ONGC), CMRI has agreed to provide scientific and technical assistance to ONGC by undertaking studies on gas desorption parameters for resource evaluation of coal bed methane in Sobhasan and adjoining areas in the district of Mehsana, Gujarat. □

for all the eight accessions of *Artemisia* with six different primers, and four accessions of *Valeriana* with two different primers. Eleven accessions of *Artemisia* were collected from several locations in Himachal Pradesh. Their genomic DNA was isolated, quantified and is being used now for RAPD fingerprinting.

Rhizospheric soil samples of *Artemisia euchroma*, *Ephedra Gerardiana*, *Hippophae tibetana*, *H. rhamnoides*, *Rosa webbiana* and *Dactylorhiza hatagirea*, collected from Spiti valley, were screened for arbuscular mycorrhizal fungi (AMF). Differences were observed in AMF population densities associated with these plants. *Hippophae* spp. exhibited highest rhizospheric AMF spore densities. □

Mushroom Farming in North-Eastern Region — RRL, Jorhat's Contribution

THE Regional Research Laboratory (RRL), Jorhat, for the last few decades has been engaged in ameliorating the economic conditions of the people in the rural and remote areas of the north eastern region by taking up extensive programmes for propagating a number of agro-technologies. Of these, the mushroom cultivation technique has gained tremendous popularity among the rural masses.

Mushroom is a good source of protein. It contains aminoacids, vitamins and essential minerals in a balanced proportion and is cheaper in comparison to other conventional sources. It can prevent/cure many diseases like anemia, diabetes, cancer, heart diseases, high blood pressure, etc. and is preferred as a nourishing food in both domestic and international market because of which it has a sustainable market within and outside the country.

Mushroom farming, taken up as a profession even at small scale, can generate good income and help solve unemployment problems. The humid climate of the NE region of India is especially suitable for cultivation of edible varieties of this non-conventional commercial crop.

RRL, Jorhat initiated its programme for popularizing mushroom farming technology in the rural areas by organizing a series of training and demonstration programme both inside and outside the laboratory, utilizing some easily available agro and plant wastes. The venture is being sponsored by the Department of biotechnology, New Delhi, as a special biotechnology project. Also, under the CSIR Rural Development

Programme, mushroom cultivation has been introduced in 10 villages of Upper Assam and five villages of Lower Assam during the period 1996-1997.

Training and demonstrations have been organized at different places in rural areas involving various sections of the people like tribal populations, army units, tea garden personnel, women and voluntary Non-Government Organizations (NGO), and government enterprises/agencies, etc. Some of the areas where training/demonstrations have been organized are:

Jorhat District

The tribal population of the flood-prone areas in and around Jorhat district are primarily dependent on agriculture for their livelihood. Initially, about 300 people from these areas and also a few families of Namdeorigaon under Dhekorgorah Block volunteered for mushroom farming. A voluntary organization called Namdeori Anchalik Mushroom Society was formed by the local villagers, comprising mostly of Deori and Mishing tribes, for facilitating the training and demonstration of the farming technology in a systematic and organized way.

Majuli

The plains tribe, scheduled tribes and scheduled castes population of Majuli district are now engaged in organized mushroom cultivation under the banner of Majuli Mushroom Growers' Society with the farming technology and guid-

Processes licensed and Patents filed by CBRI

PROCESSES licensed and patents filed by the Central Building Research Institute (CBRI), Roorkee, in the recent past include:

Processes Licensed

- C-Brick machine -- M/s Vantage Engineering Industries, Bhopal; and M/s Buld Tech, Roorkee.
- High draught continuous brick kiln -- M/s Rishabh Bricks, Burhanpur (MP).
- Stationary concrete block maker -- M/s Zeit Engineers Pvt. Ltd, Chandrapur (MS).

Patents Filed

- A device useful for concrete block maker.
- An improved process for the manufacture of natural fibre-based composite laminates useful for making plain/corrugated sheets and products thereof. □

ance provided by RRL, Jorhat. The Soil Conservation Department, Government of Assam, was also collaborating with RRL for introduction and organized cultivation of edible mushroom in tribal areas of Majuli (Zengraimukh) under its so called Watershed Management Project.

Karbi Anglong District

The training and demonstration of mushroom farming was imparted by RRL under the aegis of Karbi Nimso Chingthur Asong (KNCA), a ladies forum of Karbi Anglong dis-

tract of Assam, which has a network spreading throughout the district with nodal points at places like Diphu, Bokajan, Kheroni, Donkamokam and Hamren.

Kamrup District

Shanti Sadhana Ashram, a voluntary organization of Guwahati, has set up a mushroom cultivation unit along with mushroom spawn production laboratory based on RRL, Jorhat technology. RRL, Jorhat has also provided necessary technological inputs to Assam Agro Industries Development Corporation for setting up a mushroom spawn laboratory at Guwahati.

Golaghat District

More than 300 people from Kamarbandha Ali, Salikihat, Kanimohal, Bokalai, Bosa Bhorolua, Kacharihat, Basakumar gaon and Golaghat town area belonging to Golaghat district have taken up the mushroom farming under the banner of Golaghat Mushroom Society. The Golaghat Krishi Vikash Kendra and an NGO with more than 700 members from in and around Golaghat district have been motivated to upgrade the status of weaker sections through mushroom farming. RRL, Jorhat provided training, demonstration and supply of spawn to the people.

Dibrugarh District

The Tai Cultural Home in Namrup town of Dibrugarh district is a voluntary unit engaged in social development activities. More than 700 local youths are engaged in mushroom farming on commercial scale under the aegis of Tai Cultural

Home, with financial assistance from DRDA, Dibrugarh.

Tinsukia District

A voluntary organization called Sanjibani Agroproducts at Margherita in the Tinsukia district of Assam took up seven edible species of mushroom from RRL for organized farming at places like Dibrugarh, Tinsukia and Margherita. The State Agriculture Department of Naharkatia is also constantly collaborating with RRL, Jorhat for its proposed extension activities in the district.

Nagaon, Darrang, Sonitpur & North Lakhimpur

Markajul Ma Arif, an NGO from Hojai in Nagaon district has been keeping a constant touch with RRL, Jorhat for introduction of the mushroom cultivation in the district. Some young entrepreneurs in the Dhemaji area of North Lakhimpur and Sonitpur area in the Darrang district are presently growing mushroom with RRL, Jorhat technology on commercial basis.

Nalbari District

A voluntary agency called the Human Resources Development Organization in the Nalbari district has been acting as the nodal agency for the extension of mushroom farming in the district based on the technique developed by RRL, Jorhat. RRL has been providing all the services to the HRDO for mushroom farming. More than 900 people are engaged in the cultivation.

Dhubri District

Two batches of tribal people sent by the District Rural Develop-

Mushroom Cultivation (1996-1997)		
	No. of training programmes	Number of persons trained
CSIR	19	401
Rural Development Project		
DBT	28	446
Mushroom Project		
Under consultancy service	5	7

ment Agency (DRDA) of Dhubri under its Rural Development Scheme received training at RRL, Jorhat, on Mushroom cultivation. Another agency, the Nature's Club, also expressed their willingness and conducted training and demonstration on mushroom at Gauripur with RRL's assistance.

William Nagar, Meghalaya

The Achik Mushroom Society, a private rural enterprise in William Nagar of Meghalaya has started the mushroom farming in rural areas with RRL's help. The State Industry Department collaborated with RRL for the same and organized a seminar-cum-exhibition for the benefit of the people in which RRL, Jorhat displayed its activities on mushroom farming.

Arunachal Pradesh

More than 300 people from Itanagar, Khuncha, Bomdila in Arunachal Pradesh are engaged in cultivation of edible mushroom with the farming technology and assistance provided by RRL, Jorhat. □

CMRI suggests scientific approach for slate mining in Kangra Valley

THE Central Mining Research Institute (CMRI), Dhanbad has recently studied the mode of slate mining in Khanyara Slate Mines of Kangra valley in the district of Dharamshala in Himachal Pradesh and suggested site specific scientific approach for extraction of slate in the valley.

The slate mining in this area is an excellent example of 'Artisinal Mining' which has been in existence since the last hundred years and is carried out in an unscientific manner, resorting to outdated tools and age-old techniques.

The Government of Himachal Pradesh has, of late, taken over the mineral rights of the area which was hitherto under the control of village panchayats.

The study carried out by CMRI, at the request of Department of Industries (Geological Wing), Government of Himachal Pradesh, concludes that 'integrated strategy', which amalgamates both environment-friendly planning and extraction procedure together with social needs, should be adopted for slate mining in this area. It also suggests that during the first phase of conversion of unplanned development to a planned development, 'Underground Method of Mining' should be adopted as far as possible. If a new mine is to be opened, depending on the form of deposit, method of mining can be selected and planned scientifically to avoid further land degradation.

A total scientific package for slate mining has been recommended on site-specific basis.

Mining activities in this project area generate as much as 50% of

waste rocks and cause serious environmental concerns. Therefore, laboratory investigations were also conducted to find out the alternative uses of slate wastes. □

NAL celebrates Foundation Day

THE National Aerospace Laboratories (NAL), Bangalore's Foundation Day function was held on 14 August 1998. It featured two important lectures: the twelfth NAL Foundation Day Lecture by Shri H.S. Khola, Director General, Civil Aviation (DGCA), on 'Aviation Safety', and the Second NAL Technology Lecture, by Dr S. Srinathkumar, on 'Control Law Design and Validation for a Combat Aircraft'. Other highlights of the function were release of the NAL Annual Report: 1997-98 by Prof. R. Narasimha, who presided over the function, distribution of the NAL performance awards and, starting this year, special excellence awards to the children of NAL employees for success in studies, sports and extra-curricular activities.

Dr T.S. Prahlad, Director, welcomed the distinguished guests and the gathering. He also outlined NAL's contributions to the areas of airworthiness. "We are very keen to create an aviation safety research group at NAL, in association with DGCA and others, so that issues of aviation safety can be handled proactively", he added.

Shri Khola's Foundation Day Lecture was much awaited, especially because the last decade has been the most eventful in the history of Indian civil aviation: with sub-

stantial growth in air traffic, the entry of private air taxi carriers (ATCs), the repealing of the Air Corporation Act, etc. As Director General, Shri Khola had seen it all; indeed, he has often been the driving force behind these events.

Shri Khola talked of the early problems following the entry of private airlines; difficulties with the Air Corporation Act ("private ATC operations violated the existing Act, but we realized that we had to do something to accommodate them"); their use of very old aircraft with no training or maintenance infrastructure ("we had to quickly bring in new guidelines to stop such practices"); and the surprising fact that, in spite of the coming of the ATCs, air traffic did not really grow ("there was no expansion; only a migration of traffic on the trunk routes"). He talked of DGCA's new safety management concepts (with a shift from reactive to pro-active practices) and the mandatory requirement to install a ground proximity warning system, the mode 'S' transponder, an airborne collision avoidance system and a digital flight data recorder in every aircraft.

Shri Khola also talked of DGCA's new safety education and awareness workshops (25 workshops held so far) and the need to inculcate the safety culture ("most



accidents occur due to non-compliance of laid down procedures combined with poor weather conditions").

The highlight of Shri Khola's lecture was its wealth of statistical information: the current air traffic is just under 12 million passengers per year, and this figure has not changed much since 1996; starting with a 0.4% share in 1991, private operators now enjoy a 40% share of air traffic, 59% of all accidents occur during approach and landing, 23% during taxi, take-off and climb; 62% of all accidents are due to human error, 19% due to poor maintenance; 30% of the human errors are inadvertent, 46% are skill errors and 24% are 'deliberate' errors; during 1985-95 there were 20 serious air accidents resulting in 455 deaths, of these, 10 mishaps, involving 354 deaths, occurred during controlled flight into the terrain (CFIT).

He ended his lecture by explaining how DGCA's new safety practices have now brought accident rates down to a third of the levels existing a decade ago. This has led to a happy development—insurance companies now require Indian air carriers to pay Rs 100 crores less as premium! ("ATCs were unhappy when we first asked them to install safety equipment on their aircraft. Now they are delighted!"). With DGCA's new proposed measures ("by the end of 2000, every flight of every aircraft will be monitored"), one is hopeful that the Indian skies will become progressively safer in the coming years.

Dr Srinathkumar's Technology Lecture vividly narrated all the drama and excitement which accompanies R&D achievement. In a compelling 30 minute narrative on

the lessons learnt in the development of the LCA control law (which he likened to call the 'brain' of the aircraft; with the flight control system being the 'body and muscle'), Dr Srinathkumar explained why the man-machine interaction problem proved to be the most difficult design challenge ("we must always remember that there's a pilot in the plane, and he must be safe and comfortable"). The other challenges were: studying pilot-induced oscillations, optimization of handling qualities performance, managing the low allowable cross-over bandwidth range ("which is a real tight-rope walk") and design issues arising due to the excitation of structural modes. He also explained how the control law graduated from NAL's own design simulator ("the simulator plays a very important role, especially in rapid prototyping") to the inflight simulations on the F-16 based VISTA.

Speaking on the occasion, Prof. Narasimha described Shri Khola's lecture as "authoritative and comprehensive". He opined that the best way to integrate the North East and parts of Jammu and Kashmir with the rest of the country is with a judicious combination of civil aviation and information technologies. Calling the work done by Dr Srinathkumar's team "outstanding", Prof. Narasimha said that we do not often appreciate the true value of such technology achievements, "Five years ago we were hesitant to jump into such projects. But, today our technological capacity is maturing ("We have reached the visible stage now"). So the real determinant in the future will be how we tackle the extra-technological challenges arising out of this success. "This is a

totally different world involving markets, socio-economic factors and strategic policy. I believe it is time for scientists to learn to interact with policy makers to derive the highest benefit from these technologies", he said. Another point he made related to the growing importance of basic research in order to be a technological leader. "There are many years of basic research behind the successful LCA control law technology. How are we investing today for future successes, especially given the fact that the technology shelf life is getting progressively shorter?", he asked.

The Foundation Day function ended with a well-articulated vote of thanks by Dr R.V. Krishnnan.

NAL Excellence Awards 1998

Young Scientist of the Year

—Shri P.K. Panda, Materials Science Division, for R&D of a new process for preparation of a special grade alumina widely used in the industry, development and standardization of a thermal shock and thermal fatigue measurement test equipment.

Technology Shield for Outstanding Group Achievement

—Dr M. Shivakumara Swamy, Dr S.S. Desai & HANSA Team, for successful completion of design, fabrication and integration of HANSA-3 (prototype II) for certification.

—Dr S. Viswanath & Group, in the area of structural design, analysis.

—Dr P.K. Dash, Dr S.A. Seetharam & Group, in the area of structural testing.

—Dr R.M.V.G.K. Rao, Shri C. Pragalathan & Group, for composite fabrication.

—Shri M.U. Venkat Rao, Shri R. Ravindran & Group, for fabrication of metallic components & tool inspection.

—Shri R. Rangarajan, Shri Krishnamurthy & Group, in the area of aircraft integration & flight testing.

—Shri C.L. Narayana, Shri S. Viswanathan & Group, in the area of CFD analysis & certification.

—Ms Rajeshwari S. Ramamurthy, Shri S. Ramabhadran & Group, in the area of configuration aerodynamics.

—Dr B.K. Parida & Group, in the area of material characterisation.

—Dr A.C. Raghuram & Group, in the area of metallurgical analysis and NDE.

—Shri K.S. Venkatanarayanan, Shri N.S. Dhruva Rao & Group, for their work related to post-cure facility.

—Shri A.R. Venkatanarayana, Ms C.R. Susheela & Group, for structural test support.

—Shri A. Dwarkanath, Shri K.S. Ramakrishna & Group, for NDT and ground resonance tests.

—Shri C.V. Giriraj, Shri J.B. Shivaswamy & Group, for publicity & photography.

—COA, SFAO(SG), SSPO & Group, for Administration, Finance & Procurement.

Excellence Award in Development, Design & Project Execution

—Dr S.A. Seetharam, Structural Integrity Division; Shri Subramanya Shastry, Shri R.S. Rajagopal, Shri M.S. Kulkarni, Shri H.Y. Subramanya, Shri K. Dwarakanath; Structures Division, Shri C. Pragalathan, FRP Pilot Plant; for excel-

lence in carrying out weight reduction of HANSA composite aircraft through structural design/analysis and fabrication.

—Shri Ramesh Gangappa, Flosolver Unit, for design, development and execution of switch for many Pentiums to be interlinked to make it powerful, affordable, parallel processing platform.

—Dr N.R. Ramesh, Shri G.S. Sreenath, Shri V. S. Krishna Kumar, Shri C. Rajashekar, Shri S.R. Shyamsundar, Shri M. Baskaran, Shri A.T.L.N. Murthy, Shri M. Satish Kumar, Propulsion Division, for cavity cascade flameholders for subsonic and supersonic flows-applications in high speed air breathing propulsion.

Excellence Award in Administrative Support

—Shri T. S. Vishwanath, Administration, for excellent knowledge in latest rules and regulations and its applications, with particular reference to Fifth Pay Commission.

—Shri V. Ravi, Smt. T. Radha, Shri K.G. Subba Rao, Director's Office, for preparation, DTP composition and production of draft report of the Apex Committee to review the entire system of human resource management in CSIR.

Excellence Award in Technical Support

—Shri S.S. Sharma & Team, National Trisonic Aerodynamic Facilities, for assisting in successful completion of major aerospace programmes undertaken in the aerodynamic facilities at Nilakantan Wind Tunnel Centre by providing uninterrupted compressed air supply.

—Shri K.R. Venkatesh & Team, Electrical Section, Nilakantan Wind Tunnel Centre, for providing unin-

terrupted power supply to major installations of NTAF and other important facilities of the laboratory. □

C-MMACS Foundation Day Lecture

THIS year the C-MMACS Foundation Day lecture was delivered by Prof R. Narasimha. In the first part of his lecture, Prof. Narasimha gave a historical perspective of mathematical modelling. "Mathematical modelling is not new; even the Greeks had models for planetary motion. Only the character of models is changing". Talking of Newton's 'model', Prof. Narasimha observed that this was probably the first truly 'sophisticated' mathematical model; "it was very economical and could make incredibly accurate astronomical predictions". He then recalled Kelvin's view that "to understand physics, one must try to make a mechanical model", and suggested that it was now time to replace the word mechanical with mathematical. "Constructing an appropriate mathematical model (to describe a certain phenomenon) is perhaps the most challenging (and profitable) task of our time", he said. ("Today's high technology is essentially mathematical technology", the CEO of a giant oil company had recently told Prof. Narasimha).

What are the attributes of a good mathematical model? "Experimental agreement", Prof. Narasimha remarked, "is obviously one criterion, especially in astronomy. But fluid dynamics can be very different; in physics we hope that the unknown will reveal itself in the form of sim-

ple mathematical laws, while in fluid mechanics the laws are well-known, but we are bothered by extremely complex behaviour". Another highlight of the lecture was the lucid classification of different kinds of mathematical models; impressionistic (to gain insights into the structure with no claim to accuracy in prediction); physical (to predict quantities of interest based on assumptions not inconsistent with observed or understood physics,

and appealing to experimental data for model parameters, if necessary); rational (simpler models derivable from more complete systems by limiting processes) and *ad hoc* (provide estimates of quantities of interest, especially in engineering applications).

Prof. Narasimha ended his lecture with a discussion on modelling cloud-like flows, which has been his ardent love for well over two years now. □

HONOURS & AWARDS

Dr S. Kannan bags INSA Medal

DR S. Kannan, Scientist, Central Salt & Marine Chemicals Research Institute (CSMCRI), Bhavnagar, has been selected for the award of INSA Medal for Young Scientists (1998) for his work on catalytic decomposition of nitrous oxide.

Nitrous oxide, a potential greenhouse gas, is involved in the stratospheric depletion of ozone layer and global warming. Stringent environmental regulations call for identifying the sources of N_2O and to limit its production or emission into atmosphere. Catalytic decomposition of N_2O into nitrogen and oxygen is one of the promising energy-efficient routes to achieve this objective.

Hydrotalcite-like materials belong to the class of anionic clays, which upon thermal calcination, yield interactive, high surface area non-stoichiometric and well dispersed mixed metal oxides which

are extensively used in many catalytic transformations. These advantageous properties of the calcined hydrotalcites have been used for the catalytic decomposition of N_2O .



Dr Kannan performed the reaction in a glass static recirculatory reactor over *in situ* thermally calcined hydrotalcites of general formula $M(II)M(III)CO_3 \cdot HT$ where $M(II) = Mg, Co, Ni, Cu$ and Zn and $M(III) = Al, Fe$ and Cr (with various compositions) at 50 Torr initial pressure of N_2O in the temperature

range 150- 450°C. Among the catalysts screened, Ni and Co-containing catalysts with Al as trivalent cation showed substantial activity (even at 150°C) wherein 50% and 100% conversion was achieved at 190°C and 250°C, respectively, which is 100°C less than the most active catalyst reported in the literature.

As a result of this exciting work, Air Products and Chemicals Inc., USA, collaborated with CSMCRI and tested the materials used under flow conditions simulating the industrial process streams. The calcined hydrotalcites catalysts (especially cobalt-based) were found to offer enhanced activity over precious metal catalysts for removing N_2O from combustion and Nylon 6.6 processes. Recently, Engelhard Corporation, USA, has taken up this assignment for commercial exploitation. Efforts have already been made to process the catalyst with necessary engineering requirements and the complete flow sheet is now available for marketing.

Dr P. Pal Roy and Prof. M.M. Dhar

DR P. Pal Roy, Scientist and Prof. M.M. Dhar, former Director, Central Mining Research Institute (CMRI), Dhanbad, have begged the Hindustan Zinc Limited (HZL) Medal for their paper 'Human Response to Blast-induced Ground Vibrations: A Study based on Opinion Poll' published in the *Journal of Institution of Engineers (India)-MN*, Vol.77, November 1996. □

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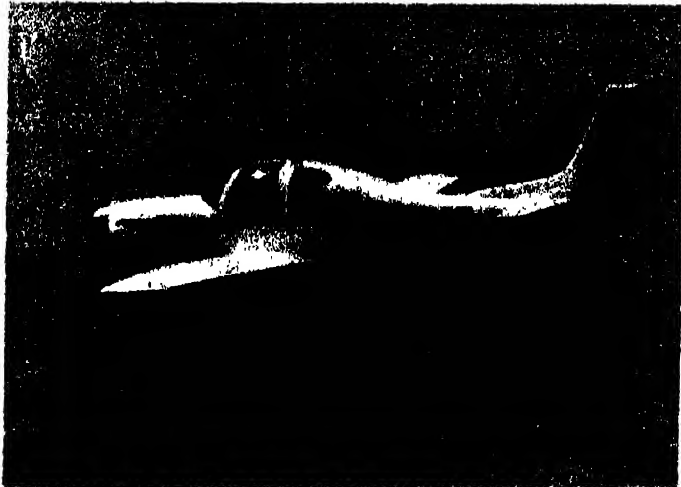
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CSIR NEWS



R & D at National Aerospace Laboratories (NAL), Bangalore: (clockwise from top left) inaugural flight of HANSA-3 prototype II; influence coefficient measurement test on the LCA fin; production of carbon fibre prepregs; and the 4 m x 8 m computer-controlled autoclave developed for NAL in partnership with BHEL, Trichy. A report on the R&D accomplishments of NAL during 1997-98 appears on p.276

ITRC helps detect mustard oil adulteration in Delhi and Lucknow

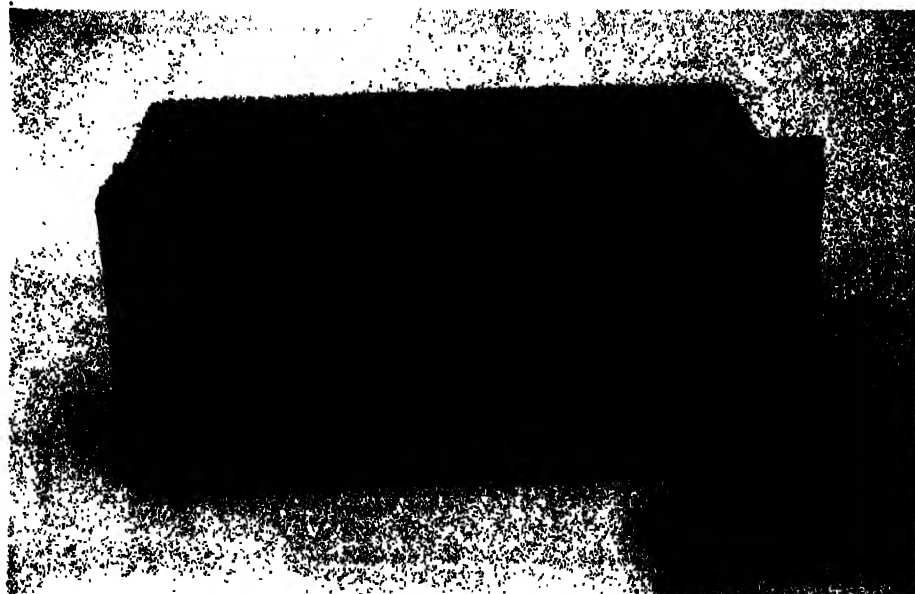
EVER since its inception, the Industrial Toxicology Research Centre (ITRC), Lucknow, has been involved in the work on food toxicology through its several surveys and public awareness programmes. The appropriate action taken by regulatory agencies as a result of these has helped in ensuring a significant reduction in the use of non-food grade additives.

ITRC has put in continued effort to work on the mode of toxicity of argemone oil, and has encountered sporadic cases of epidemic dropsy over the last 15 years. Generally, these cases are reported during the months of July to September.

Following the occurrence of this problem in Delhi recently, a team of ITRC scientists rushed to Delhi and met analytical laboratory personnel assessing the magnitude of the disease. The main objective was to help expedite the screening of contaminated mustard oil by the newly developed ITRC kit for argemone oil testing. Work on the development of this kit had been done under a Technology Mission on Edible Oils and Pulses (TMO&P)-funded project.

The kit offers a simple, sensitive and quick method for screening the argemone oil contamination in mustard oil. This kit has been successfully used and provided expeditious screening for the argemone oil adulteration in mustard oil samples in Delhi. However, the kit is not designed to offer quantification of argemone oil content.

In addition to testing of mustard oil in Delhi, a need was felt to screen the presence of argemone oil in the mustard oil samples being sold in the local markets of Lucknow. A total of 114 non-



Argemone detection kit developed by ITRC

branded, loosely sold samples of mustard oil were procured from various markets on the outskirts of Lucknow, generally catering to rural areas. It was surprising to note that on an average every fourth sample of mustard oil contained argemone oil. This alarming situation warranted an urgent action to save the unsuspecting consumers and was brought to the notice of State authorities. Continued consumption of such contaminated oil otherwise might have led to an outbreak of

dropsy epidemic in these localities on a pattern similar to Delhi.

As a precautionary measure, the consumers were advised to avoid consumption of suspected mustard oil. Early symptoms of this disease are vomiting, diarrhoea, fever, swelling and pain in lower limbs, generally affecting all or most of the family members. On noticing such symptoms, persons consuming mustard oil should discontinue the use of that batch of oil and consult their physician. □

Technology Transfer

CSIO enters into agreement for production of medical instruments with two firms

IN separate functions organized at the Department of Science & Technology (DST) and Department of Electronics (DoE), Government of India, on 27 July 1998, the Central Scientific Instruments Organisation (CSIO), Chandigarh, en-

tered into agreements with the following firms for transfer of technology for the production of Drug Infusion Pump & Controller, Pulse Oximeter and Resuscitation Bag for Neonates, developed by CSIO with funding from DST and DoE:



Transfer of CSIO technology on Medical Instruments at a function held at DST, New Delhi. Prof. V.S. Ramamurthy, Secretary, DST (centre) presided over the function. Prof. S.K. Guha, Chairman, DST's steering committee on Medical Instruments and Prof S. Mohan, Director, CSIO, are also seen in the photo

1. M/s Pranavam Lifecare Instruments (P) Ltd, Cochin
2. M/s Soimit Electronics & Medicare Systems, SAS Nagar

Prof. V.S. Ramamurthy, Secretary, DST, who presided over the function held at DST, lauded CSIO's efforts in accelerating the transfer of technology. He pointed out that in the present scenario, R&D cannot be a one-shot affair; there should be constant efforts to update the technology continuously so as to maintain its relevance. Earlier, during the demonstration of the equipment, Prof. Ramamurthy evinced keen interest in the technology developed by CSIO. The DST Secretary was also appreciative of the prototype made by the industry, which was also displayed.

Giving a background leading to transfer of technology, Prof. S. Mohan, Director, CSIO, brought out that almost a year ago, a suggestion was made by Prof. S.K. Guha, and Dr R.P. Singh that CSIO should organize an Industry get-together to market its technologies. Following the suggestion, a get-together was held and on a single day, CSIO was

able to market as many as four technologies to a number of companies. Subsequently, CSIO also organized a bigger industry get-together on national scale in December 1997, which was presided over by Dr R.A. Mashelkar, Director General, CSIR. In this, the lead role was played by

the Medical Equipment Division of CII. After seeing the developments made by CSIO and its other activities in the area of medical instrumentation, the member companies of CII felt that CSIO was the most appropriate place for undertaking R&D on medical instrumentation and that CSIO could serve as the R&D arm of the industry, Prof. Mohan informed.

Dr R.P. Singh, Adviser, Instrument Development Programme (IDP), DST, stated that CSIO has been identified as a Nodal Centre for Core Group Activity in medical instrumentation. While appreciating the efforts made by CSIO, he suggested that CSIO should step up its efforts in medical instrumentation.

Prof. S.K. Guha, Chairman of the Steering Committee on Medical Instruments of DST, and other senior officers of DST were also present on the occasion, in addition to the CSIO's development team.

In the function organized at DoE, CSIO signed the technology transfer agreement with M/s Pranavam Lifecare Instruments (P) Ltd, Cochin, for



Shri S. Mukhopadhyay, Senior Adviser, DoE, handing over the technology transfer document on pulse oximeter to Shri P.S. Sasidharan, Managing Director, M/s Pranavam Lifecare Instruments (P) Ltd, Cochin. Prof. S. Mohan is also seen in the photo

pulse oximeter. Shri S. Mukhopadhyay, Adviser, DoE, presided over the function. Shri P.S. Sasidharan, MD of the company, brought out that his company had created all the

necessary facilities for productionization of the equipment. Since he was in touch with the market, he would improve the aesthetics and ergonomics of the instruments so as

to improve their marketability. Production of these medical instruments was going to be launched in August 1988, Shri Sasidharan added. □

R&D Highlights

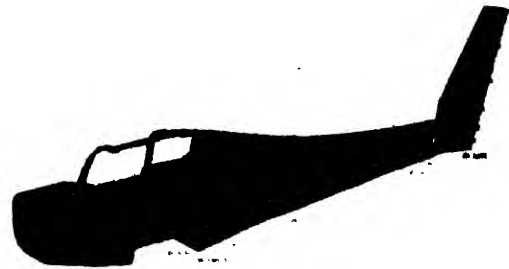
NATIONAL AEROSPACE LABORATORIES, BANGALORE

THE inaugural flight of the second prototype of *HANSA-3* on 11 May 1998 was a special moment for the National Aerospace Laboratories (NAL), Bangalore, as well as CSIR. The aircraft was flagged off by Dr Murli Manohar Joshi, Union Minister for Human Resource Development and Science and Technology. Shri Ananth Kumar, Union Minister of Civil Aviation; Dr R.A. Mashelkar, Director General, CSIR and Directors of 40 CSIR establishments, who had assembled at NAL for the CSIR Directors' Conference, were present to share the joy of this success. Indeed, it marked a major milestone in the *HANSA* programme, because NAL teams, after many months of assiduous work, had succeeded in reducing the aircraft's all-up weight by about 100 kg; and thereby ensuring that *HANSA* could be certified under the JAR-VLA umbrella.

With the 2-seater *HANSA* programme now in its last phase, the focus will start shifting to the *HANSA* stretched version, where preliminary studies have commenced, and the more ambitious *SARAS* multirole light transport aircraft programme. The Technology Development Board (TDB) of the Government of India has agreed to support the *SARAS* development project. NAL has now formalized

partnerships with Hindustan Aeronautics Limited (HAL), Taneja Aerospace & Aviation Limited (TAAL), Kumaran Industries Private Limited (KIPL), Central Mechanical Engineering Research Institute (CMERI), Structural Engineering Research Centre, (Chennai), and Aircraft System Test Establishment (ASTE) for the joint development of *SARAS*. These synergistic partnerships should result in the development of a truly outstanding aircraft. The detail design of *SARAS* is now drawing to a close, and NAL is gearing up for 18 months of intense *SARAS*-related activity.

In the recent past, NAL began the process of transferring the technology for production of carbon fibre prepreps to IPCL, Vadodara. Initial studies on the



Structural analysis (top); Fuselage test set-up (middle); and Horizontal stabilizer test set-up for *HANSA-3*

prepreg performance are quite encouraging. This technology, developed with support from ADA and TIFAC, is expected to prove to be very valuable for India's future composite aircraft programmes.

Other major activities of the NAL's various divisions/units during 1997-98 are presented here:

Advanced Composites Unit

The unit was created during the year in view of NAL's growing involvement in the area of advanced composites. While LCA-related projects will largely engage the Unit's attention, a significant amount of work will relate to non-destructive evaluation and the use of repair technologies. The Unit is now involved in the development of LCA centre fuselage components and has successfully completed the static testing, including functional tests, on the LCA fin and rudder.

Aerospace Electronics and Systems Division

The Division is increasing its involvement in the area of avionics. The system integrator for the proposed SARAS avionics system has been identified and the architecture for the electrical system has been finalized. Negotiations are in progress for the fabrication of the master box and test rig. The work started last year in the area of active noise control is progressing well and the duct for conducting experiments will soon be ready. The Division has initiated a new activity on global positioning system-based navigation techniques. The Division's Computational Electro-magnetics Group is concentrating primarily in the areas of radomes, aircraft antennas, and its work to set up an ex-

Carbon Fibre Epoxy Prepregs

A prepreg can be viewed as a composite precursor in which approximately collimated reinforcing fibres are preimpregnated with a precise amount of resin and curing agent formulation to produce the required tack, drape, toughness and other processing and performance characteristics. Airframe manufacturers using advanced composites rely on prepregs for their unique features. Some of the advantages are: (a) prepreg eliminates resin formulation control, (b) assures consistent resin reinforcement ratio, (c) offers reproducible thickness and mechanical properties, (d) provides consistent and high quality, and (e) is suitable for assembly line production.

At NAL, a process has been developed for producing aerospace-grade carbon fibre prepregs using the hot-melt resin film transfer technique. In this method, a silicon-coated release paper is first coated with a thin film of the resin melt using a doctor blade. In a subsequent step, the coated resin film is transferred to a collimated bundle of carbon fibres in a heated impregnation zone by sandwiching the carbon fibres between two layers of the resin film under heat and pressure. The carbon fibres were procured from Indian Petrochemicals Corporation Limited

(IPCL), Vadodara and the epoxy resin was synthesized and formulated at NAL. The entire process for making the epoxy resins, blending with curing agent and other additives to make the formulation has been developed at NAL with support from TIFAC and Aeronautical Development Agency (ADA). A prepregging machine available at Defence Research and Development Laboratory (DRDL), Hyderabad, was shifted to NAL after ADA persuaded DRDL to agree to this arrangement. This machine was used for undertaking prepregging trials, and to standardize the process of making prepregs. The prepregs have now been characterized and cured laminates made from these prepregs have been tested for mechanical properties. The 6k carbon fibre prepregs developed at NAL conform to the specification requirements of aircraft applications. The prepregs are capable of delivering an out-of-refrigeration life of at least 60 days at 22°C, and have a storage life of more than a year when stored at -18°C. The technology of making carbon fibre prepregs is being transferred to IPCL for commercial exploitation. The process to obtain type approval for military aircraft applications is on.

—M. K. Sridhar

perimental microwaves facility is progressing well.

Centre for Civil Aircraft Design and Development

The Centre was involved in the reduction of the structural weight of HANSA-3II, which was achieved by

a judicious use of different thicknesses of foam and glass cloth and the lighter Rotax engine. The Centre is also leading the SARAS detail design effort and has made significant progress in the detail design of the wing, fuselage and empennage. The CATIA facility at the Raj Mahin-

The SARAS Synergy

THE Technology Development Board (TDB) at its meeting in August 1997 agreed to support the SARAS development project involving building of two flying prototypes, one structural test specimen and carrying out the necessary tests for type certification. With the approval from TDB, and the participation of public and private sector industries and sister CSIR labs, the SARAS project is now on a firm technical and financial foundation.

The participation of several organizations, together with their combined strength and expertise, will impart great synergy to the SARAS development programme. For example, the participation of Hindustan Aeronautics Limited (HAL) and Taneja Aerospace & Aviation Limited (TAAL) will bring in expertise in aircraft production; Kumaran Industries Private Limited (KIPL), in numerically controlled machining; Central Mechanical

Engineering Research Institute (CMERI), in mechanical design, prototype fabrication and solid modelling; Structural Engineering Research Centre (C), in structural analysis and structural testing of full scale structures; and Aircraft System Test Establishment will bring in its expertise in flight test planning, flight testing and analysis.

At NAL, the detail design activity of SARAS is continuing with significant progress achieved in almost all the areas. All the drawings and documentation pertaining to the horizontal tail have been completed and the drawings released for fabrication. The tools for making sheet metal components have been fabricated and the assembly jig is nearing completion. The design of other major assemblies like wing, fuselage and fin are in advanced stages of completion. Many of the associated tools, and the structure of the assembly jigs have been fabricated. The design

of all the major systems has been completed and the equipment has been selected. A full-scale mock-up of the nacelle was fabricated and an installation review, with a mock-up engine supplied by Pratt & Whitney, Canada, was completed successfully. High speed wind tunnel tests on the 1/20th scale model were conducted in the 1.2m trisonic wind tunnel; the second phase of this test programme to study the effect of flap and control surface deflections is under way. Low speed tests on the 1/6th model were also carried out in the 19' x 14' open circuit wind tunnel at Indian Institute of Science.

With this tremendous momentum now achieved at NAL and the extraordinary synergy which will arise out of so many organizations working together, it does appear that the SARAS aircraft is heading for a flawless and timely take-off.

—Dr K.Y. Narayan

dra CAD Facility is being extensively used in this exercise.

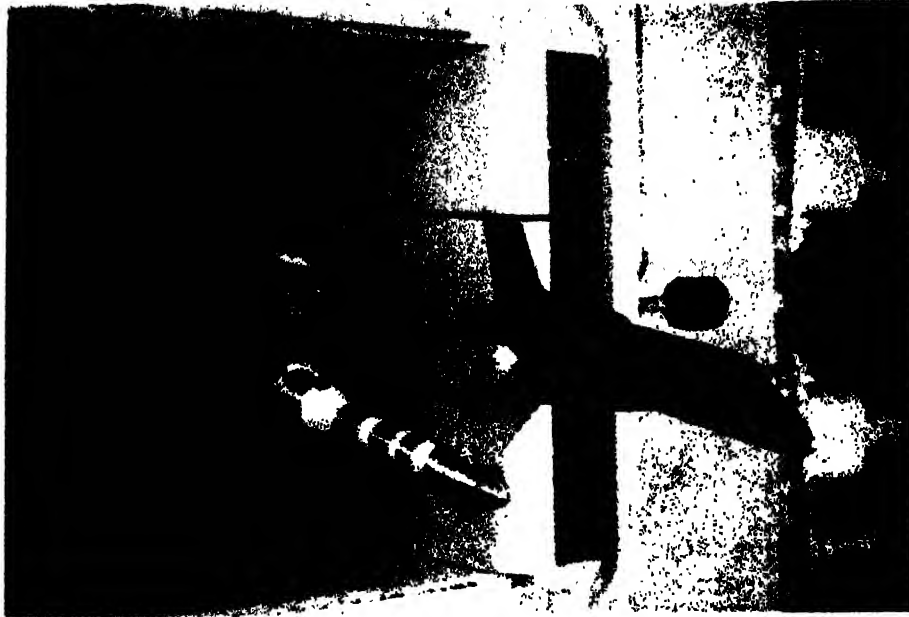
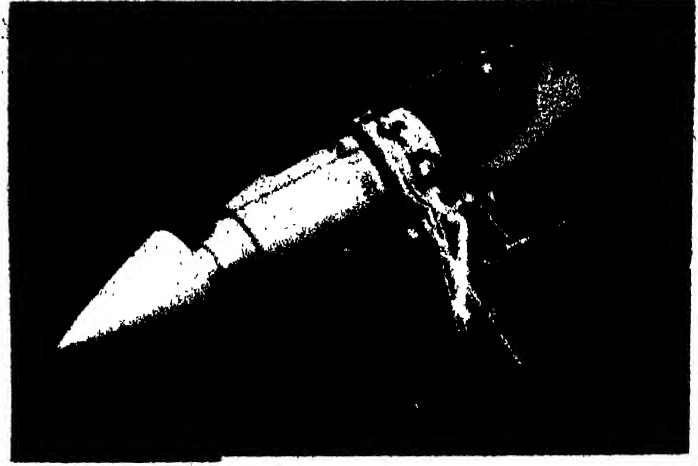
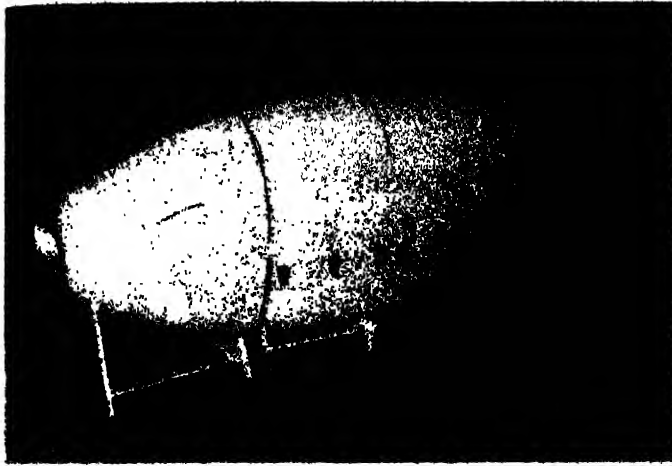
Computational and Theoretical Fluid Dynamics Division

The major emphasis in the Division was on the development of advanced CFD codes for predictions in real-life applications. The ongoing projects being handled by the Division include a new design-information system for DRDL, work on torpedoes with stern appendages and highly skewed marine propellers for NSTL code development for VSSC's satellite launch vehicles and the development of Doppler weather radomes for ISRO. The Division has also initiated computations on flow through a turbine cascade using a 3D RANS code, in association with Propulsion Division.

Experimental Aerodynamics Division

Work was continued in the areas of drag reduction technology, turbulent and separated flows, de-

velopment of test techniques and aircraft and other flight vehicle aerodynamics. In the context of SARAS programme, a review was undertaken to study active and passive devices for induced drag reduction. The study revealed that while many devices do offer induced drag reduction of engineering value, their application to design must take into account other factors like device drag, weight penalty and other structural implications. Among other projects, the Division prepared a report for the Karnataka State Road Transport Corporation, on aspects of drag reduction em-



SARAS Project: (clockwise from top left) A view of the nacelle (fabricated out of FRP) with air-inlet in front and exhaust in the rear; CATIA view of the routing of fuel, air and control lines in the stubwing; and aircraft model in the 1.2 m wind tunnel

playing passive shaping techniques. Initial studies point to the possibility of significant fuel savings, especially on inter-state transport. The contract research project on relaminarization on swept wings for the Boeing Airplane Company was reviewed and plans for 1998 were finalized.

Flight Experiments Division

The activities of this Division have been reoriented to focus on aircraft maintenance and operation, flight testing and flight research and prototype development and integration of HANSA. The Division played a pivotal role in the integration and testing of HANSA-3II, notably in the

exercise to integrate the new Rotax engine with the HANSA aircraft.

Flight Mechanics and Control Division

The major effort of the Division continued to be oriented towards the LCA project. The LCA TD-1 control law design phase has been successfully completed. The testing of the flight control laws for the initial flights of LCA TD-1, with a wide range of coverage for nominal and failure conditions, with and without tolerances, is now on. The Division also has the responsibility to undertake the flight data analysis of the LCA TD-1 and estimate the aircraft's

stability and control characteristics. The Division's stabilized output error method (SOEM) parameter identification algorithm is expected to play a major role in this exercise. The engineer-in-the-loop realtime simulator continued to provide valuable support to the LCA control law development; the simulator has now been upgraded with a powerful graphics computer to improve the visual texture of the display.

Flosolver Unit

The Unit achieved good success in the development of a high speed communication interface for Super-Solver; this interface is expected to significantly improve the scalability

Computation of Naval Hydrodynamics Problems

NAVAL Hydrodynamics is a potential area where use of the recent advances of CFD are gradually proving to be invaluable asset for design and analysis of ships, submarines and similar structures. Some serious research and development efforts have been initiated in the CTFD Division in the area of naval hydrodynamics during the last five years under the sponsorship of the Naval Science and Technological Laboratory (NSTL), Visakhapatnam and, more recently, with the support and assistance of the newly formed Naval Research Board, Ministry of Defence. Under three different research projects, a three-dimensional panel code based on method of singularities for inviscid flow computation and a three-dimensional Reynolds-Averaged Navier Stokes (RANS) code in boundary-fitted co-ordinates employing state-of-the-art turbulence models have been developed and validated extensively for a variety of real-life problems in the area of naval hydrodynamics.

Pre-processors for generation of surface panels on the body under consideration and also for generation of body-fitted volume grids in or around complex geometry, numerical algorithms for solution of the relevant flow equations, tur-

bulence modelling and suitable post-processors for flow visualization form the four major areas on which development efforts have been concentrated. An efficient differential algebraic hybrid algorithm has been developed for the generation of smooth and boundary-orthogonal volume grid for complex arbitrarily shaped hull configurations. The panel code is based on a low order singularity distribution technique where constant sources are distributed to simulate the thickness effect and the lifting effect is simulated by doublet distributions on the mean surface of the lifting components. The flow solution algorithm for the finite volume RANS code based on the pressure-velocity solution strategy employs non-orthogonal body-fitted grids with multiblock computation facilities, collocated variable arrangement coupled to the low diffusive upwind schemes for convective flux discretisation and different variants of the eddy-viscosity based $k-\epsilon$ turbulence model for simulation of turbulence effects. The RANS code has been validated and used extensively for a wide variety of problems. Some of the important problems studied are: flow around a submarine sonar dome at different vessel speeds, flow around axisymmetric underwater

bodies of different cross-sections and flow around the complex-shaped stern end of a ship hull. Extensive validation has been carried out through comparison of the computation results against available measurement data on surface pressure, skin friction as well as for field data on mean flow velocity components and turbulent stresses also in some of the situations studied. The panel code has already been validated against the available detailed measurement data on the DTMB P4119 propeller. Suitable post-processors have also been developed for display of the contours of important flow variables and numerical visualization of the flow through particle traces. Work is now in progress to analyze the viscous turbulent flow around underwater bodies with stern appendages and also for flow through marine propeller using the RANS code and also in developing a large eddy simulation (LES) code for analyzing flow around underwater bodies. The CFD software developed for analysis of naval hydrodynamics problems and their current updates are being ported to the computing platform of NSTL for further use in future for other application problems.

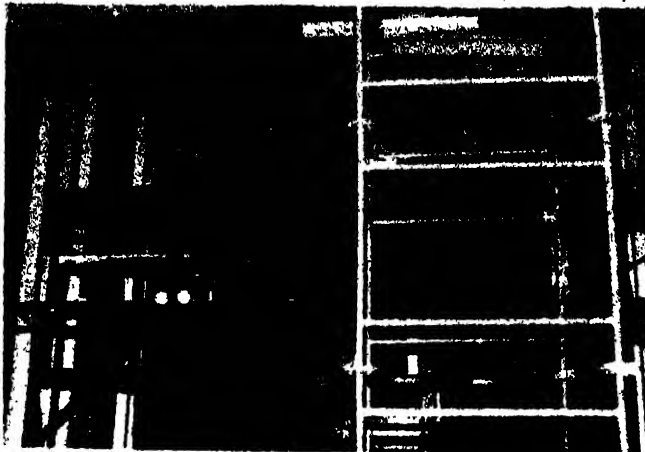
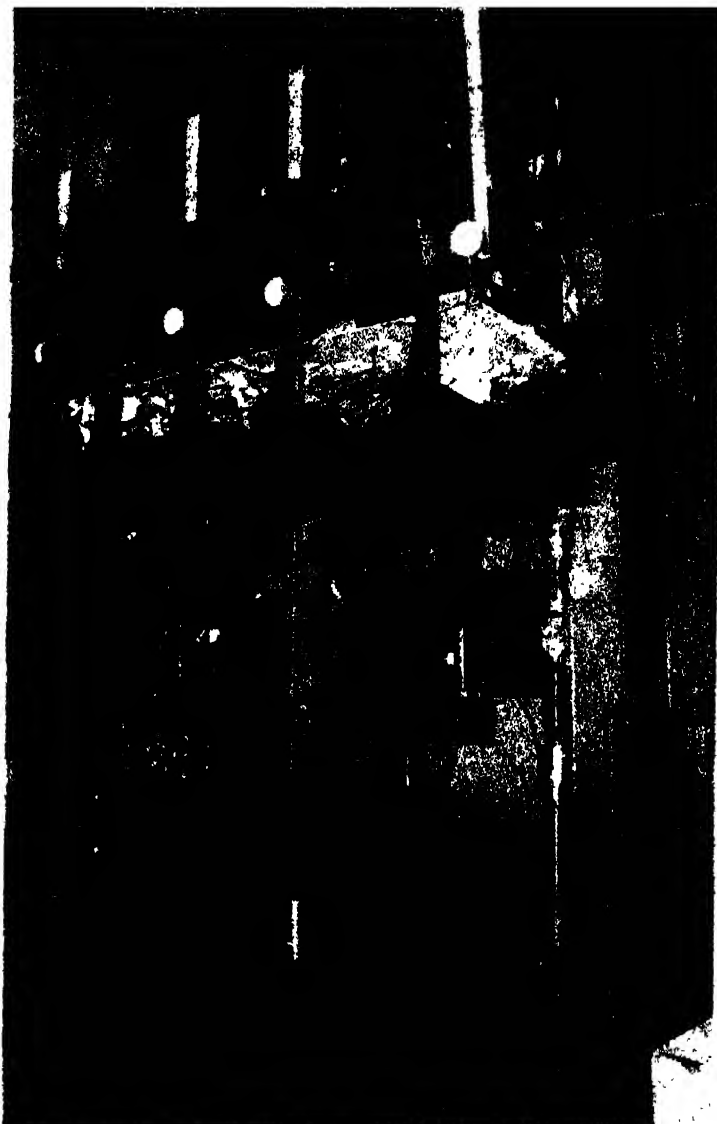
—Dr S. Majumdar

of the parallel computer. The Unit continued its studies on weather prediction codes with special reference to the T-80 GCM code. One interesting finding was that parallelizing only the physical domain latitude loops results in poor efficiencies when the number of processors exceeds four. To get higher

efficiencies, it appears necessary to parallelize the linear calculations also in the spectral domain. The Unit completed its project to parallelize a molecular dynamics code for Hitachi, Japan and has now obtained a second parallelization contract from Hitachi.

FRP Pilot Plant

The Pilot Plant, which will now function as an independent unit, was busy with the fabrication activity related to the HANSA-3II. The Unit's room temperature vacuum bag moulding technology was used to fabricate the fuselage, wing and



LCA Project: Rudder with whiffle free loading (ultimate load test) (left). A view of the test set-up for buckling of CFC-panels with/without ply-drops (top); and fin with whiffle free loading (ultimate load test)

control surfaces of HANSA. The Pilot Plant is also involved in the development of the 12.8 diameter sandwich radome for ISRO.

Materials Science Division

In addition to the successful development and transfer of the carbon fibre prepreg technology, the Division carried out several improvements on its automatic visual range assessor (AVRA) unit and also introduced enhancements in its innovative optical approach slope detector system (OASIS). A PC-based data acquisition system has been developed for the Inter Univer-

sity Consortium, Indore, for thermo-physical characterization of materials up to 1000°C. The Division also developed a novel method for producing shaped castings from metals and alloys.

Surface Engineering Unit

A major activity of the Unit related to the development of pressure sensitive paint which could be used to measure surface pressure on airfoils in wind tunnel studies. A very promising compound for this exercise has been identified after studying the oxygen quenching efficiency of fluorescence of several candidate compounds.

National Trisonic Aerodynamic Facilities

The focus continued to be on aerodynamic data generation in the 1.2m trisonic wind tunnel for various national aerospace programmes; 1148 blowdowns were conducted in 1997-98. The emphasis of tests for ADA was on aerodynamic performance enhancement of combat aircraft configurations using leading edge manipulators such as LEVCON and vortex plates. Among the tests for VSSC was the time-march test done on a multi-booster launch vehicle configuration to determine the trajectories of

Drag Reduction using Riblets on Aircraft Components

Study of turbulent skin friction drag reduction using riblets, which are micro-grooves on the surface aligned along the flow direction, has been an area of significant research during the last decade. Riblets with symmetric v-grooves manufactured by 3M company (USA) have been widely used in research. Following early investigations in the literature on simple 2D configurations, NAL initiated an active programme to assess viscous drag reduction and understand aspects of flow structure on typical aircraft components in low as well as transonic speeds.

Detailed experiments made on NACA0012 and GAW(2) airfoils at

low speeds demonstrated for the first time increased viscous drag reduction due to riblets with airfoil incidence; the drag reduction was as high as 15% at an incidence of 6° on both the airfoils. Flow measurements indicated that the increased viscous drag reduction resulted from the airfoil upper surface suggesting strongly 'increased effectiveness of riblets in adverse pressure gradients'. Similar findings were evident on a supercritical airfoil at transonic speeds as well.

Recently, a detailed study has been completed extending riblet effectiveness on a swept wing with GAW(2) airfoil section at low speeds. The drag reduction at zero

incidence was comparable to the 2D airfoils while the effectiveness gradually reduced at finite incidence. The results strongly indicate the importance of aligning the riblets along the surface streamlines in order to achieve maximum drag reduction on a swept wing. The assessment of riblets on a wing-body configuration representative of a transport aircraft is currently in progress.

The effectiveness of riblets for the reduction of base drag on a GAW(2) airfoil with a blunt trailing edge has also been demonstrated recently.

—Dr P.R. Viswanath

boosters separating from a core vehicle using the semicaptive trajectory technique concept developed at NAL. Tests were also undertaken for DRDL and in a limited test for ADRDE, the performance of a special type of parachute, used for sta-

bilization of the pilot's ejection seat in a military aircraft, was studied.

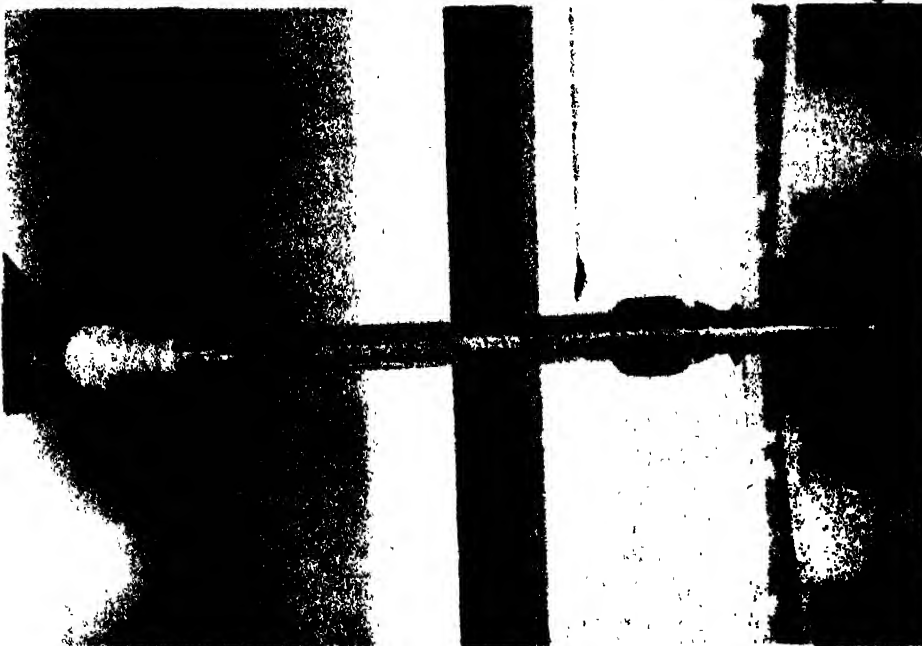
Propulsion Division

Good progress was recorded in all ongoing projects, especially those related to the *Kaveri* engine

and LCA. The collaborative project with CAE, China, to design and develop an advanced fan stage with a 2:1 pressure ratio is progressing smoothly. The Division has also begun a series of projects on high Mach number cooled turbine cascade testing for Pratt & Whitney, USA. Other projects are in the area of supersonic combustor development and testing of the compressor and combustor for the low-cost gas turbine; the compressor performance was mapped up to 87% of the design speed. And, in what was probably a world first, the Division successfully test flew a single-seater powered hang glider fitted with a specially modified and air-cooled Wankel rotary engine.

Structural Integrity Division

The Division executed several sponsored projects during 1997-98, including the analysis and testing for



Typical long range missile model mounted in the test section of 1.2 m wind tunnel

Supersonic Combustor Development

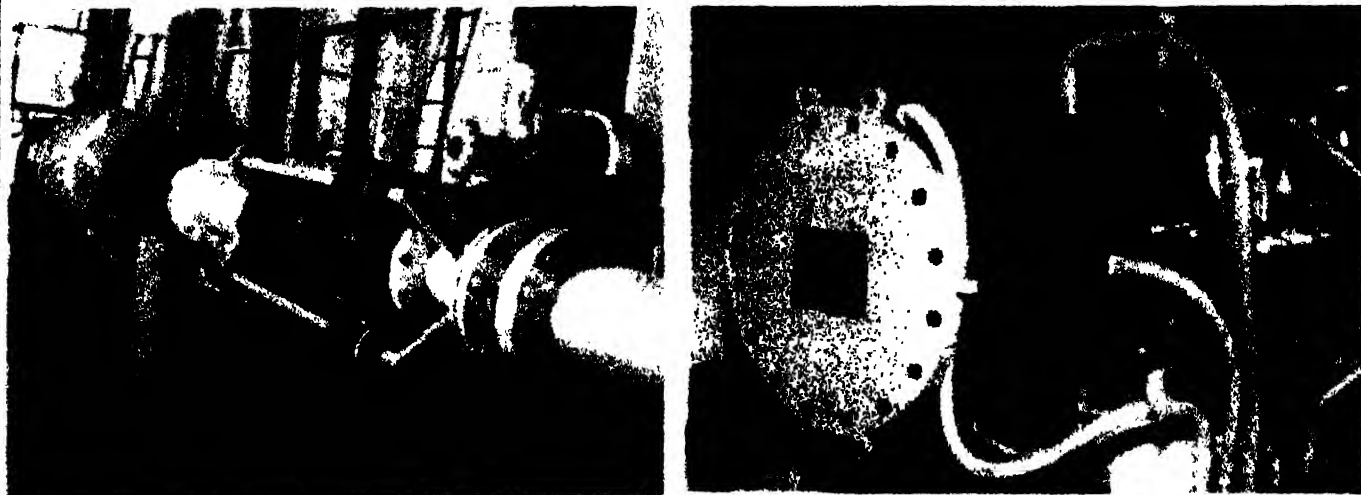
IF truly low-cost space launch operations are to be achieved, launch vehicles which are fully reusable must eventually be developed. Propulsion is the most important pacing technology for speeds at which these flight vehicles are to fly. However, there is no single propulsion cycle or concept that is optimum for the entire flight Mach number range from takeoff to orbit. Consequently, the propulsion system would have to be a synergistic combination of the three basic propulsion cycles — rockets, turbojets and ramjets. Performance studies have indicated that a supersonic combustion ramjet (scramjet) would be the best choice for an engine in the range of Mach numbers above 4. It would

be an essential component of a rocket based combined cycle (RBCC) engine when operated as a dual mode ramjet/scramjet or as a pure scramjet.

DRDL, Hyderabad has an ongoing programme to develop a hydrogen fuelled supersonic combustion ramjet for the hyperplane, which will be a fully reusable, single stage, hypersonic vehicle. Under a programme sponsored by DRDL, NAL has developed the technology for the design of supersonic combustors. A direct connect supersonic combustor test facility, which is suitable for simulation of flight at Mach 6, 30 km altitude has been successfully set up. The supersonic combustion of hydrogen in a Mach 2 airstream

has been demonstrated. A novel method of achieving flame stabilization using a cavity cascade has also been developed. This avoids placing solid obstacle flame stabilizers in the flow and also allows for distributed heat release in the supersonic combustor, thus achieving high performance. For volume limited supersonic missile applications, kerosene would be a more suitable fuel. The supersonic combustion of kerosene, aided by hydrogen, has also been successfully demonstrated. Such supersonic combustors could be employed in the proposed RBCC engine of the VSSC air breathing launch vehicle.

—Dr J.J. Isaac



Supersonic combustor test facility developed under sponsorship of DRDL

lug damage tolerance studies for Boeing Airplane Company. The chief objective of the Boeing study was to establish correlations between analytically predicted stress intensity factors and fatigue crack growth rates with increasing crack length in a pin loaded lug specimen.

For ADA, the Division continued its activity relating to the testing and certification of composite features and components. The Division was also involved in the mechanical property characterization of the carbon and glass fibre composites

employed in the HANSA development.

Structures Division

The activities of the Division have now been reoriented with the creation of groups for structural

analysis and design, structural dynamics, mechanical design and advanced research. The Division played an active role in the *HANSA* and *SARAS* development programmes, notably stress analysis and structural analysis of the *SARAS* wing, rear fuselage and control surfaces and weight reduction and other structural changes in *HANSA-3II*. In a major initiative, the Division improved the frequency resolution of the shake test system, handed over to HAL a few years ago for ALH testing, by an order of magnitude across all frequency ranges. This was achieved by developing new hardware involving a PC, a digital signal processor and other associated hardware and software. The Division also continued to support mechanical design activity related to the 4m x 8m autoclave and wind tunnel models and continued its basic research in field-consistent and higher order elements.

Wind Energy Group

The Group continued its work in the area of wind resource assessment and wind energy studies at Antarctica. Two innovative ideas for future wind machine installations have now been successfully tested at India's *Maitri* station in Antarctica.

Technical Services

The first phase of NAL's proposed campus-wide network became operational. Network connectivity has been established within

the Belur and Kodihalli campuses. The Computer Support and Services Division played a major role in this project. The Engineering Services Division was almost entirely occupied with the fabrication, quality control and assembly of non-FRP structural components of the *HANSA-3II* and the mechanical, electrical and civil works related to the development of 4m x 8m autoclave for HAL. The newly reorganized Estates and Buildings Unit was busy managing NAL's civil construction activity. The Unit has played a central role in civil work related to the LCA wing/fuselage development programme and the construction of a new aircraft hangar at the Nilakantan Wind Tunnel Centre.

The Information Centre for Aerospace Science and Technology (ICAST) is currently in the middle of a major programme involving library automation and bar coding. Information about most of the library books has now been automated. The Information Services & Systems Section has successfully set up the campus intranet and created NAL's Web site on the Internet. The Project Monitoring and Evaluation Section played pivotal role in ensuring that the laboratories' external cash flow stayed above the Rs 300 million mark. The actual external cash flow during 1997-98 was Rs 304.1 million. Of this, about 64.4% came from ADA — 34.4% for the CFC wing project and 30% for other LCA-related projects.

The Technical Secretariat successfully negotiated 15 business development agreements and continued to manage the training and student programmes. □

CMRI signs MoU with MOEF

THE Central Mining Research Institute (CMRI), Dhanbad, has recently signed a Memorandum of Understanding (MoU) with the Ministry of Environment and Forests (MOEF), Government of India, in connection with a project on 'Environmental Monitoring and Compliance in Specific High Priority Areas—Mining Sector'. This is a part of the Environmental Management Capacity Building Project undertaken by the Government of India with assistance from the International Development Association (IDA), for strengthening the environmental management capacity of the country.

According to this agreement, CMRI would act as Executive Agency for the following two tasks out of four stated objectives of the project:

(a) Review of the existing environmental and leasing policies, laws/regulations, and standards governing the mining sector, and monitoring and compliance mechanisms for their implementation.

(b) Best practice demonstration projects (other than coal) in different parts of the country.

CMRI would be responsible for not only providing expert technical assistance but also executing the plans and programmes effectively for successful completion of these tasks while MOEF, being the nodal agency, would oversee the functioning of the project and provide necessary assistance to the executive agencies. □

Khagol Vigyan Ke Naye Kshitij

PROF. Jayant V. Narlikar, Director, Inter University Centre for Astronomy and Astrophysics (IUCAA), Pune, delivered the Golden Jubilee Lecture on *Khagol Vigyan Ke Naye Kshitij* in Hindi at the Indian Institute of Chemical Technology (IICT), Hyderabad, on

16 July 1998. Dr B.G. Sidharth, Director, B.M. Birla Science Centre, Hyderabad, presided over the function and also launched the Hindi Bulletin of IICT *SPANDAN*.

In his lecture, Prof. Narlikar said that since ages astronomy has been providing a lot of information about



During the Golden Jubilee Lecture of IICT, seen on dais (from left) are: Smt. Sailaja, Prof. Narlikar, Dr Sidharth, Dr K.V. Raghavan and Dr P.V. Diwan; and a view of school children during the question-answer session with Prof Narlikar

Know-how for Green Roof Strong Prop released

THE know-how for Green Roof Strong Prop, developed by the Central Mining Research Institute (CMRI), Dhanbad, has been released to Bilaspur Mining Industries, Bilaspur, for its commercialization. □

planets, stars and their movements. Kepler had made new theories on these studies which are helping us to send spaceships, satellites, etc. into the space. He extensively discussed the achievements of Hubble telescope, distant galaxies and the possibilities of life in the universe other than earth, and efforts being made on sending messages to them in codes from earth.

Dr K.V. Raghavan, Director, IICT, welcomed the distinguished gathering and said that Hindi has to be used as an effective medium to popularize science among masses.

Vote of thanks was proposed by Smt. V. Sailaja Giri Rao, Hindi Officer, IICT.

Later on, Prof. Narlikar met the school children, during a specially designed programme 'Meet your Scientist' and answered questions asked by them. Three best questions were awarded mementoes □

Convocation at Indo-Swiss Training Centre, Chandigarh

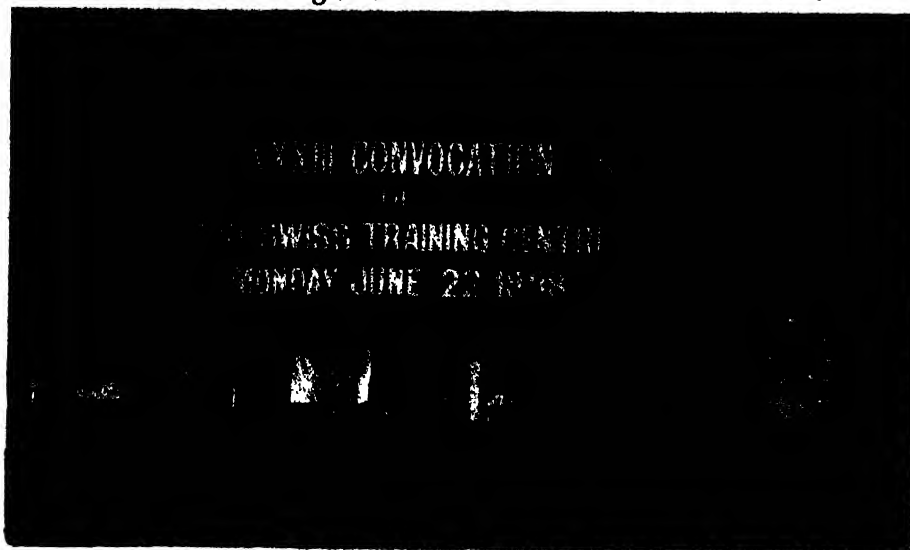
THE Indo-Swiss Training Centre at the Central Scientific Instruments Organisation (CSIO), Chandigarh, organized its thirty-third annual convocation on 22 June 1998. A total of 55 students were awarded Diplomas/Post Diplomas in the disciplines of Instrument Technology (20), Mechatronics & Industrial Automation (15), and Die & Mould Making (20).

Padamshree Chander Mohan, Chairman, North India Technical Consultancy Organisation Ltd, and former Vice-Chairman & Managing Director, Punjab Tractors Ltd, was the Chief Guest on this occasion. In the Convocation address, he stressed upon the need of translating science into reality. Emphasizing the need for constant learning, he said that in this fast changing world,

everything becomes obsolete after sometime. Therefore, one must keep oneself constantly updated. He also stressed the importance of time, and exhorted the students to value 'discipline' in life. He added that the industrial and corporate world has changed radically because of excess capability in energy sphere, and success today depends on overcoming the competition. The concept world over is to generate money and resources, and those failing to do so will not survive, he added.

Earlier, Prof. S. Mohan, Director, CSIO, welcomed the Chief Guest and highlighted the activities of ISTC. He also awarded diplomas to the students. Shri Chander Mohan gave away prizes to the students who excelled in various streams.

Shri P.S. Malhotra, Principal, ISTC, presented the annual report of the Centre. □



During the convocation of Indo-Swiss Training Centre of CSIO, seated on the dais (from left) are: Shri P.S. Malhotra, Principal, ISTC; Padamshree Chander Mohan, Chief Guest; Prof. S. Mohan, Director, CSIO and Shri R.K. Jain, Faculty Member, STC; and a view of the audience

TRAINING PROGRAMMES

Mushroom Cultivation

S PONSORED by CST-UP, a two-week training programme on Mushroom Cultivation was organized by the CSIR-Polytechnology Transfer Centre (PTC), Lucknow, from 27 May to 9 June 1998. The programme was inaugurated by Dr P.K. Seth, Director, Industrial Toxicology Research Centre, Lucknow. In his address, he apprised the trainees about the economic aspects of mushroom cultivation. He described how mushroom has become the choice food of the masses because of its nutritive value and easy digestibility. He also released a book in Hindi on *Mushroom Utpadan: Ek Safal Udyog*, written by Dr R. K. Srivastava, Scientist-in-Charge, CSIR-PTC Lucknow.

Application of Spatial Technology in Environment Management

ENVIRONMENT management demands an accurate knowledge-base of interactions of human activities with earth system. The spatial technologies like geographic information system (GIS) and remote sensing (RS) are emerging as effective technological aids to use this knowledge-base for developmental planning, including environment management. The application of computers in using remote sensing data and its integration in GIS domain provides planners and implementing agencies timely information on environment, particularly to control pollution. Improvement in environment management requires government functionaries to be armed with advanced computer-aided techniques for planning, formulation and monitoring of environmental policies.

A training programme on Application of Spatial Technology in Environment Management was organized by the National Institute of Science, Technology and Development Studies (NISTADS), New Delhi's Resource Planning and Utilization for Regional Development Group, at New Delhi, during 10-14 August 1998. The objectives of the training programme were to discuss the inter-relationships of technology, natural resources and environment on the one hand and assess the resulting impact on socio-economic structures on the other. The focus of the programme was on creating awareness about the usefulness and timeliness of the application of spatial technologies in

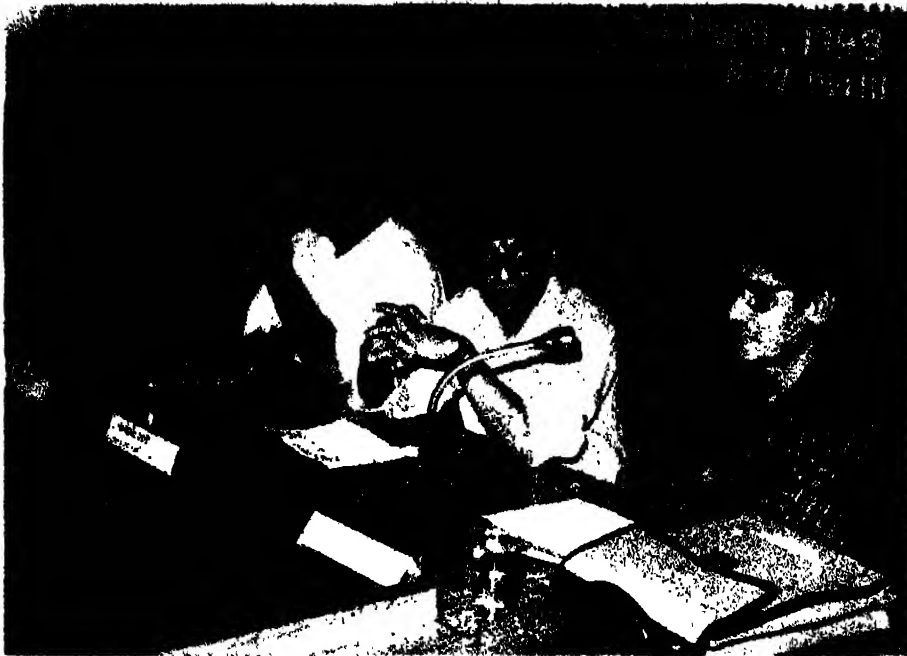
Dr P. K. Seth, Director, ITRC, releasing the book, *Mushroom Utpadan: Ek Safal Udyog*, during the inaugural function of training programme on Mushroom Cultivation, organized by CSIR-PTC, Lucknow, and a view of the participants

The programme covered various aspects of mushroom cultivation, spawning, composting and pasteurization and preservation of the product. Lectures were also delivered on marketing, project management, financial assistance from various government agencies, preparation of project profile, etc.

In the valedictory function, Shri Mamraj Singh, IAS, Spl. Secretary, Science & Technology, U.P. Government, distributed the certificates,

alongwith the book released on the occasion, to the candidates. The book has been written in common man's language, covering almost all aspects of mushroom cultivation alongwith project profile, addresses of machinery suppliers, spawn producers, dealers, etc.

Dr R.K. Srivastava spoke on the aspects involved in establishment of mushroom cultivation unit and solution to the common problems and constraints faced in the process. □



Dr Subhan Khan, Scientist, NISTADS, addressing the participants of training programme on 'Application of Spatial Technology in Environment Management' Seated to his right is Dr Ashok Jain, Director, NISTADS, who inaugurated the programme

environment management. The programme was sponsored by the Ministry of Environment and Forests under the World Bank-aided Industrial Pollution Control Project. The participants were from Central and State Pollution Control Boards and a few central government institutions.

Inaugurating the training programme, Dr Ashok Jain, Director, NISTADS, stated that spatial technologies could be an effective instrument for monitoring and implementation of policies. Presently, sectoral policies for pollution control come under different departments and agencies of Central and State governments. These also include institutions, both at national and local levels for environment management responsible for planning and implementation of development projects in sectors like energy, industry, water resources, transport and agriculture. He emphasized that government functionaries and public must be made

aware of environmental implications to developmental activities in order to be able to make informed choices. To educate citizens about environmental risks, the economic and health dangers and threat to resources, it is essential to provide periodic information about the environment in an understandable manner. Access to information in the form of thematic maps on different environmental themes is highly desirable for quick and timely monitoring of environmental pollution and for policy making. It is easy to convince people about the status of environment through maps.

The training programme had two components: expert lectures and practical exercises. The expert lectures were grouped into three categories: (i) Foundation topics covering concepts and policy issues, (ii) Basics of spatial technologies, and (iii) Application of spatial technologies. Expert lectures were

delivered on human dimensions, global climatic change, environmental implications for intellectual property rights, hazardous chemicals, environmental information systems and basic concepts and theories of spatial technologies. Case studies on application of spatial technologies were presented on land, noise pollution, zoning and based on environmental consideration and impact of industrial air pollution on human health. The participants were also given hands-on training on computers as how to prepare maps and apply spatial technologies. At the concluding session, it was emphasized that there is a need to have a comprehensive approach to integrate environment and socio-economic aspects at all levels in development planning and decision-making processes.

HONOURS & AWARDS

Dr M.G.A. Padmanabha Setty and Dr S. Radhakrishnan

THE name of Dr M.G. Ananth Padmanabha Setty, a retired Assistant Director of the National Institute of Oceanography Goa, has been included in the 15th edition of the Marquis *Who is Who in the World* for his contributions to Oceanography.

Also, the name of Dr S. Radhakrishnan, Scientist, National Aerospace Laboratories, Bangalore has been selected for inclusion in the 16th edition of the above publication.

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